MACHINING DIESEL ENGINE CRANK-SHAFTS

NEW YORK SEATTLE

MOTORSHIP

Devoted to Commercial and Naval Motor Craft

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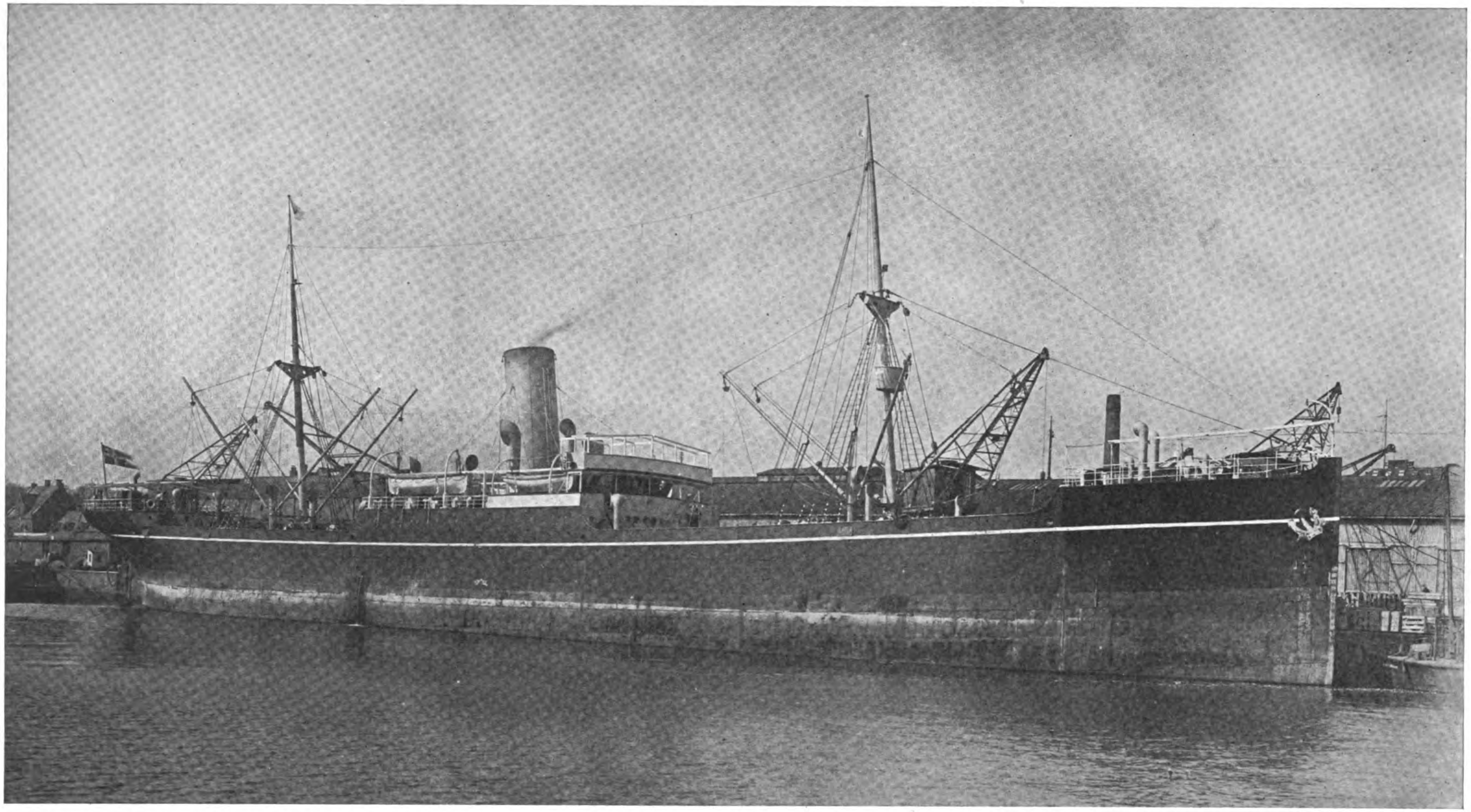

MODERN ECONOMICAL MERCHANT SHIPS—No. 36

The converted steamship "FOLKVARD" now owned by the Norwegian Government and a frequent visitor to New York harbor. Three sister ships were converted to Diesel power at the same time by Harland & Wolff and were known as the "Bandon," "Pangon" and "Chumpon," but have been renamed "Folkvard," "Lidvard" and "Landvard." All are single-screw vessels of 6,000 tons d.w.c. and have a six-cylinder Burmeister & Wain type oil-engine of 1,300 shaft h.p. (equivalent to 1,500 steam i.h.p.) at 110 r.p.m. The main advantages gained by the conversion were: Gain of about 800 tons cargo-capacity; fuel-bill reduced to one-third; and absence of firemen and their worries. The fuel saved per ship is about 20 tons per day, and the 600 tons of bunker oil now carried is sufficient for 16,200 nautical miles. The present daily consumption is 8 tons, including 2 tons for the donkey-boiler and ¼ ton for the auxiliary oil-engine; length, 330 ft.; breadth, 47 ft. 3 in.; depth, 25 ft. 7 in.

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MOTORSHIP

Trade Mark, Registered

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Australia—Gordon & Gotch, Sydney & Melbourne.

The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. Steamships are becoming decadent. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon.

February, 1920 Vol. 5 No. 2

EDITORIAL

ABUSE OF THE AUXILIARY SAILING-SHIP

TO-DAY there probably is no type of cargo-carrier in such disfavor with domestic shipowners as wooden-built motor-auxiliary sailing-ships. Incidentally, no type of vessel has received greater abuse in service from shipowners and their captains. For an extended period "Motorship" has endeavored by means of articles to install into the minds of shipping-men the fact that the motor-auxiliary sailing-ship —preferably of steel construction—on many trade routes is a very successful and efficient type of craft if properly-designed, adequately-powered, well-equipped, soundly-constructed and intelligently-operated; whereas, if badly-arranged and unwisely-operated in unsuitable trades, it is one of the greatest white-elephants shipowners could possibly have. So, it is very unfortunate that some owners and builders have not sufficiently studied the question of the auxiliary ship, to realize these differences, because, had they done this, we would hear less regarding the non-success of this class of vessel, and more about their commercial practicability.

Many of the ships now in service, as we have frequently indicated, can neither sail at any practical speed when under canvas alone, nor make any reasonable speed when only under motor power. The result is that the owners and their captains insist upon the low-powered auxiliary oil-engines being run constantly for the entire voyage in order to make port as quickly as possible.

In other words, the average auxiliary vessel is not run as an auxiliary, but as a full-powered ship; and when failure occurs, or her engines give trouble, the owner blames the motor power or the vessel as a type, whereas he himself or his superintendent-engineer is chiefly to blame. Also twin-engines of high-speed sometimes are installed in a big ship instead of a single slow-speed engine with large propeller, while in a fleet of wooden sailing-ships built here for France steam-machinery actually was fitted—a step which promised trouble before the hulls were launched.

A typical case of what we may almost term "blatant abuse" of auxiliary oil-engine power recently was brought to our attention. We refer to the wooden ship "S——," a schooner of about 4,000 tons d.w.c., with but 700 shaft h.p. in twin screws. On one trip from New York, U. S. A., to Santos, Brazil, the time at sea occupied 38 days, 22 hours. For no fewer than 37 days, 12 hours, of this period the engines were running, the vessel averaging about 6.8 knots. On the following voyage this was practically duplicated.

On the first voyage she had aboard 2,900 tons of coal in her hold, and 600 tons of iron pipe on her deck, without counting fuel in her bunkers; so, here was a vessel carrying 3,500 tons of net-cargo in her hold (or equivalent to a full-powered steamship of about 7,000 tons loaded displacement) being forced along at her utmost speed without any rest to her inadequate propelling power.

At times when there was a good breeze she would average 9.5 to 10 knots for about 36 hours; and although the maximum propeller speed was 9.5 knots, her comparatively high-speed oil-engines were kept going without the rest which they deserved after continuous full-load operation. We say "comparatively" because they had about three times the revolution-speed that they would have had had this vessel been a full-powered steamship.

Evidently, this ship also has insufficient sail, as we understand that the maximum speed she has made without power is not much over 7 knots. On another voyage she had a total of 3,780 tons of freight, without counting her fuel stores and water. Her draught for this load was 27 ft. Yet her owners expected 700 shaft horsepower to drive her at practical speed for over a month at a stretch with the assistance of the moderate amount of canvas. Had she double that power, her speed would average 9 knots and her total fuel-consump-

tion would not exceed 50 barrels per 24-hour day, which consumption would be very low for a ship of her capacity. The extra power, of course, would reduce her capacity by about 150 tons.

Therefore, in view of the foregoing we were not surprised when we learned that this ship has suffered quite a little engine trouble, which was accelerated by the fact that her oil-engines were the first pair to be constructed by her inexperienced (at that time) builders, and were from an entirely new design. We wish to make it clear that we are not commenting unfavorably against the oil-engines, as the design in question has some most excellent features, and the minor weaknesses in the early design have been eliminated, to the mutual benefit of both owner and builder. So, under the circumstances, they were given unusually severe work and performed excellently. Also, she broke one of her tail-shafts—an occurrence nothing to do with the motors—with the result that the insurance people would only pass her as a sailing ship. So, the other propeller was removed, and since then this vessel has been running as a sailing-ship.

When shipowners learn how to plan out an auxiliary and how to operate her, we shall hear less and less of the failure of this class of boat and more and more about the success, especially if of steel construction. The past and present ill-treatment of a promising type of ocean cargo-carrier is most unfortunate, since there are many instances which conclusively demonstrate that the motor auxiliary can more than hold its own against the coal-burning or oil-fired, full-powered, steel steamship, particularly on long-distance voyages favored with trade winds. Whether or not large auxiliaries are more economical than full-powered motorships has yet to be decided.

We will repeat the recommendation which we recently made regarding the minimum amount of power that should be installed in auxiliaries with which owners desire to use the power for 25 per cent or over of the time at sea.

Loaded displacement tons.	Power B.H.P.	Fuel consumption for 24-hrs. running. In barrels.	Average loaded speed without sails. In knots.
2,000	500	14 to 16	7½
3,000	700	21 to 23	8
4,000	900	24 to 28	8¼
5,000	1,100	32 to 36	8½
6,000	1,250	38 to 40	8¾

The consumptions are figured on both surface-ignition and Diesel oil-engines, the lower figure being for the latter type. In boats over 3,000 tons we suggest single-screw machinery.

If less power than this be installed the oil-engines should only be run when entering and leaving harbors and during the calms when the ship would otherwise drift, also in times of emergency. Provided, a large steel auxiliary be properly powered and canvassed there is no real reason why she should not average 9 knots loaded over a year's cruising with the engines running not more than 50 per cent of the time at sea. This gives a practical ship which can obtain steamer prices for freights with about one-third of the operating costs, regardless of the question of the number of crew to be carried under the laws, or by union requirements.

SMALL AUXILIARY SAILING-SHIPS AND THE UNIONS.—LEGISLATION NEEDED

WOODEN vessels up to about 2,000 tons have been in use for a couple of centuries, and even to-day are regarded as practical by the majority of shipowners. regardless of the poor results of many larger wooden ships. Thus there always will be a demand for such a vessel, and from general operating viewpoints the oil-engined auxiliary wooden sailing-vessel of 1,000 to 2,000 tons capacity offers the greatest advantages in coastwise and overseas services. But, unfortunately, there appears to be no law regarding the manning of such craft, and the Unions in consequence are free to make such demands regarding crews that as soon as freight-rates drop and full cargoes become scarce, they will be uneconomical to operate. Therefore, legislation is urgently needed.

In these vessels it is intended that the sails are to be used for the principal motive power and auxiliary oil-engines provide mechanical propelling power when there is no wind. Consequently the machinery is idle for much of the period at sea.

Take the case of an auxiliary of about the size of the one described and illustrated in our January issue, the present law does not state how many men shall be carried, but the Unions insist upon seven men being carried in the engine-room (usually a small compartment in the stern of the ship) consisting of Chief, 3 engineers, and 3 oilers. Also the Unions insist upon eight men on deck.

This results in the excessive engine-room crew sitting about idle part of the time with no work to do, incidentally eating up the profits and spoiling the morals of the rest of the crew. It should be obvious that a total of five men in the engine-room of a vessel of this size is ample, and Congress will do well to pass a law at the earliest possible moment definitely stating the number of men to be carried in the engine-room of both auxiliary and full-powered motorships of various tonnages and power.

THE FUNCTION OF THE TECHNICAL PRESS

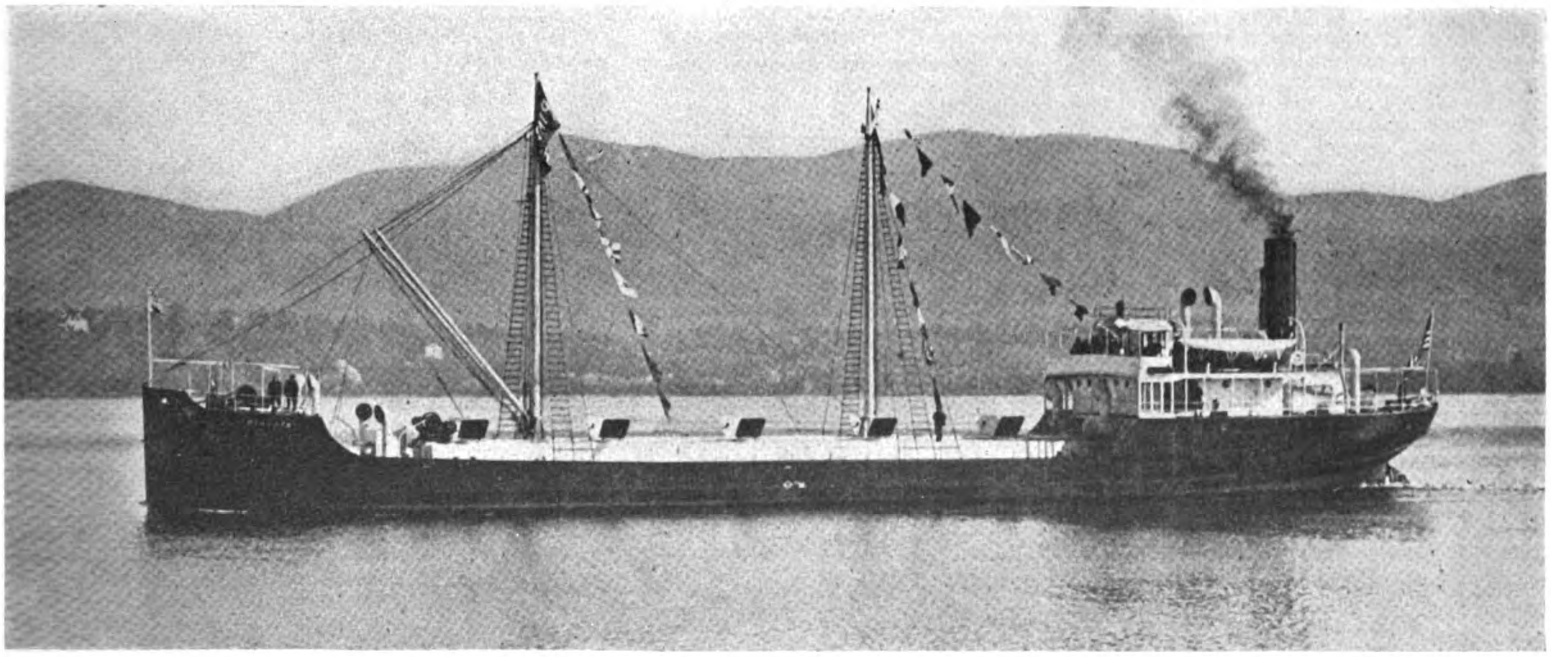
MANY things occur in the Old World about which we of the New World would rarely hear—and vice versa—were it not for newspapers and magazines. But for their far reaching tentacles we should never know of thousands of happenings abroad and even in our own great country. Every section of the Press has its own particular function. The daily papers circulate the general news of this Planet and promote loyalty and patriotism; the story-magazines internationalize fiction and other light reading. also illustrate customs of other nations; while technical publications — such as "Motorship" — keep their readers fully informed concerning engineering progress and inventions going on in all parts of the Globe, as well as making valuable recommendations for future lines of scientific and industrial developments.

Information that travels by word of mouth quickly becomes distorted and exaggerated as it passes along, and being unreliable often is actually harmful. Also it is not permanent, whereas published matter usually is reasonably correct and in addition forms a permanent record for history. Thus the Press performs a highly important function in furthering the interests of the country; especially the technical Press, which for those reasons alone deserves the heartiest support from the particular industry that each periodical is fostering, regardless of direct sales-returns from such advertising, as it takes extremely clever "copy" to regularly sell ships or big engines by advertisements alone.

Recent issues of "Motorship" form a most interesting example of how the distribution of valuable business and engineering information can be gathered and made available to the American industry. But, the work of obtaining and publishing such material can only be done at great expense; and, as it is distributed to readers at extremely low cost a large advertisement section of the magazine is very necessary. The support of the latter by the entire marine industry is a simple way of acknowledging appreciation of the useful function of "Motorship."

Yet, strange tho' it may seem, there are a few powerful companies in the domestic marine field who refrain from advertising on general principles and who do not support the marine-engineering and shipbuilding journals regardless of their merits and useful work. It is not that they cannot afford it, as they have been paying excess profit taxes, but merely because the old-fashioned policy was formed at the outset and since strictly adhered to.

(Continued on page 129)



The new motor tanker "Pinthis" built at Newburgh, N. Y., and propelled by a 500 shaft h. p. Bolinder oil engine

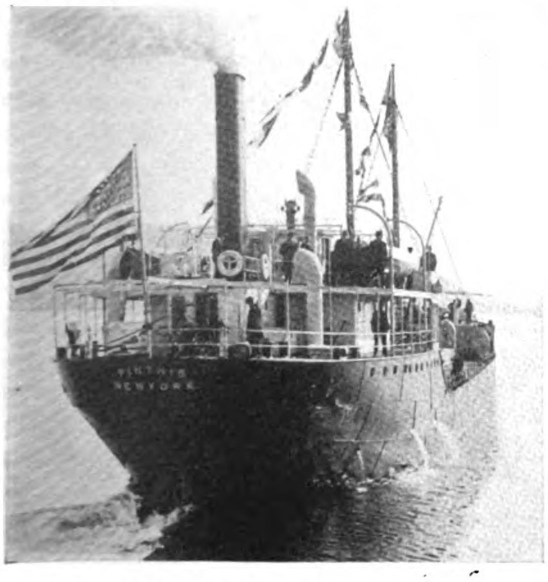
Another Hudson-Built Steel Motor Tanker

"Pinthis," a Motorship of 1,750 Tons D. W. C., Propelled by Bolinder Surface-Ignition Oil Engines for U. S. Coastwise Service

LAST summer we described and illustrated a new steel motor tankship built on the Hudson river at Newburgh by the Tank Ship Building Corpn., in which a six-cylinder 500 b.h.p. Diesel oil-engine of the four-cycle type is installed. The same yard recently completed and ran trials of a sister vessel, named "Pinthis," which, however, has a four-cylinder two-cycle type surface-ignition oil-engine. In one respect it is unfortunate that the vessels are not owned by one firm, as their results in service would make a most interesting comparison—which data would be of greater value if a third sister ship with steam machinery were completed. The "Bayonne," as the Diesel ship is named, is owned by the Vacuum Oil Company of New York City, and the "Pinthis" is owned by the Sugar Products Company, also of New York. On the other hand it is fortunate that her present owners have purchased her as it means the entry of another important American firm into the motorship owning business.

The Sugar Products Co., we believe, have not previously owned a motor ship, so we trust that they will arrange the grade of the engineers of the vessel according to a larger ship, as by so doing the youngest and least experienced operators will not be placed in charge. It is most important that skilled men be employed in the engine-rooms of motorships at this stage of the development, and many a good job has received poor treatment through bad handling.

Steam auxiliaries have been fitted but we believe Diesel-electric would have been more satisfactory, and the system is uneconomical, and the necessary boiler water makes weight that will infringe upon the cargo capacity of the ship. Although the ship is of but 1,750 tons d.w.c., the space for fresh water for the boiler-feed allows for 103 tons, whereas only 54¼ tons of bunker-oil is carried. Electric auxiliaries would have dispensed with all steam-piping both on deck and below, and the same power would have been obtained on one-third of the fuel consumption, and in addition to reducing the fuel bill would have increased the earning power of the ship by adding to its cargo capacity.



Stern view of the motor tanker "Pinthis"

The "Pinthis" is a fine looking ship and doubtless her builders feel pleased with their work now that she is afloat. She has been built to Lloyd's highest class and has the following dimensions:

Length overall	216 ft. 7 in.
Length between perp	208 ft.
Moulded breadth	35 ft. 6 in.
Moulded depth	17 ft. 4 in.
Radius of bilge	4 ft.
Designed deadweight	1,750 tons
Designed mean draft	15 ft. 3 in.
Main engine power	500 shaft h.p.
Bunker-oil capacity	54.2 tons
Fresh water for boiler feed:	
Fore peak	44 tons
After peak	21 tons
Double bottom	38 tons
Daily service tanks, 2 tanks	5.2 in.
Lubricating oil storage	200 gal.
Propeller—pitch and diam	6 ft. 3 in. by 8 ft. 6½ in.
Speed of ship	9 knots
Engine speed	160 R.P.M.

The speed attained during the trial trip was 9½ knots. The fuel-consumption of the main engine was not ascertained definitely on account of the fact that the fuel for the main engine as well as for the donkey boiler had to be taken from the same tank, but it was gauged to about 0.52 per B.H.P. an hour.

All accommodations, with exception of the deck crew's quarters in the forecastle, as well as the engine-room, are located aft. We have not seen this ship, but have been advised that the arrangements and details are well considered and carried out in a practical and convenient way. The engine-room is large and light and a good working space provided around the main engine and all the auxiliaries. The main engine is a Swedish built 500 B.H.P. Bolinder of the surface-ignition type with air-injection of fuel. The engine is direct-reversible and turns over at the moderate speed of 160 R.P.M.

No. 12—Reserve air compressor driven by a 3 h.p. direct connected gasoline engine. This air compressor is used very exceptionally, as for instance after repairs to the starting air receiver.

No. 13—Lubricating oil tank.

No. 14—Starting air receiver.

No. 15—Fire pump.

No. 17—Electric switch board.

No. 17—Turbo driven electric generator. This generator set consists of a single stage turbine direct connected to a 10 K.W.D.C. general electric generator. The whole set is carried by two bearings only and manufactured by the Steam Motors Company, Springfield, Mass.

No. 18—Kerosene tank.

No. 19—Storeroom.

No. 20—Working bench.

Forward of the bridge and bulkhead is a space of four feet to the first tank bulkhead. This space is divided by the centre line bulkhead and is used for bunker fuel oil. The capacity is about 54 tons. The bunker tanks are provided with heating coils and double piping to the service tanks. The 3 ft. high and 18 ft. wide expansion trunk starts from the bridge and bulkhead and is carried over the bunker trunk and all the cargo tanks. These latter comprise 10 tanks—5 on each side. Each tank is made tight so as to allow carrying of various liquids at the same time. Each tank is provided with a heating coil, as this tanker will be used for carrying molasses.

Forward of the cargo tanks is the pump room. All the pumps are direct acting steam pumps, and the connections from the tanks are well carried out so as to enable the emptying of one tank into any one of the others as well as overboard.

A small cargo room is also provided for forward of the pump room.

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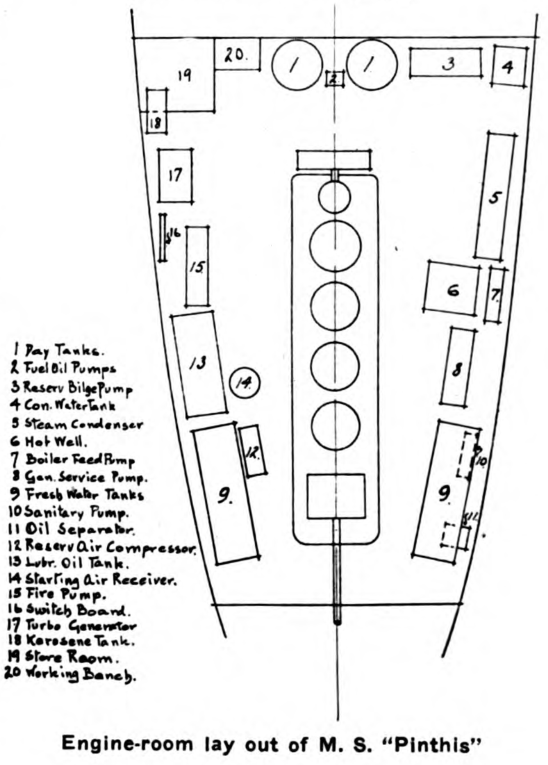


Engine-room lay out of M. S. "Pinthis"

The tanker which is to be used in coastwise traffic is not fitted out with any wireless station.

All the auxiliaries except the reserve air-compressor are directly or indirectly driven from a boiler built by the Vulcan Iron Works and fitted out with a "White burner." The boiler is located on the upper deck forward of the engine-room bulkhead, and steam is generated at a pressure of 120 lbs. per square inch.

The following description of the engine-room refers to the sketch on the previous page:

No. 1—The service tanks connected up to main engine as well as boilers.

No. 2—Electric-driven rotary-pump used for pumping fuel-oil from the bunker to the two service tanks.

No. 3—Direct-acting duplex steam-pump used as reserve bilge-pump. The daily bilge-pump is a standard equipment with the main engine.

No. 4—Condensed water tank.

No. 5—Steam condenser.

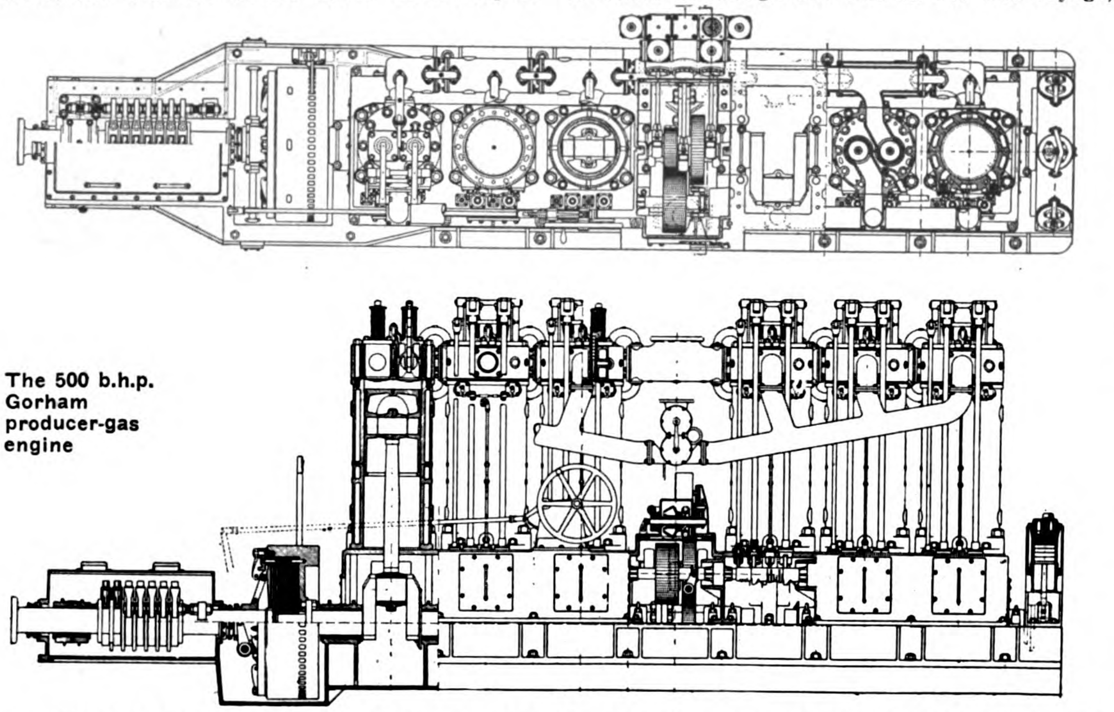
No. 6—Hot well.
No. 7—Direct-acting duplex boiler feed-pump.
No. 8—General service pump.
No. 9—Fresh-water tanks (5.2 tons).
No. 10—Sanitary pump.
No. 11—Electric-driven De Laval oil separator.*

*This is able in a very short time to purify all waste oil collected by a pan. The oil consumption in this way is brought down to a minimum without cutting down the lubricating-oil supplied to the engine.

TWIN-SCREW 1,000 B.H.P. PRODUCER GAS ENGINE SET

Now under construction at the plant of the Gorham Engineering Company of San Francisco, Cal., are two 500 b.h.p. internal-combustion engines of the four-cycle, electric-ignition, constant-volume type, which will be installed in a vessel in conjunction with a producer-gas plant. It is said that this vessel will be in the Oriental service where coal is comparatively low in price.

Each engine has six cylinder, 17" bore by 20" stroke, and will run at 220 r.p.m. Reversing is accomplished by means of compressed-air, provided for by a compressor arranged at the forward end of the engine. One of the leading features of this engine is the possibility of control and reversal by means of a single hand lever which shifts the cam-shaft into the various positions, five in number. Situated at a point about the middle of the engine is the control lever, located inboard in the case of a twin-screw installation. This control lever is provided with a five-notch quadrant, the central notch being the neutral or stop position, the next notch forward and astern being the starting position for forward and astern respectively, while the farthest notches forward and astern are the full speed or running position respectively. The inlet and exhaust cams are somewhat different in construction from the usual type on such motors, insofar as each cam is really a sleeve on which are turned the four profiles for starting and full speed ahead and astern.



The 500 b.h.p. Gorham producer-gas engine

The ignitors are of the make and break type, now being provided for each cylinder. They are driven from a multiple eccentric mounted on the cam-shaft which is designed to give both retarded and advanced ignition for both ahead and astern rotation. The air starting valve is driven by means of cams, two of which are provided for each starting valve, one each for the ahead and astern starting. The ignitor and starting valves are also operated by means of push rods fitted with roller guides at their lower extremity. The sides of all cams and eccentrics have been turned to a flat angle which will allow the roller guides to climb when shifting the cam-shaft from one position to the other.

AUXILIARY MOTORSHIP "OZMO" DEMONSTRATES HER RELIABILITY

Some time ago the motor auxiliary schooner "Ozmo" managed by Geo. McNear, Inc., of San Francisco, left Seattle for Bethel, Alaska, 175 miles up the Kuskoquim River, and 2500 miles from Seattle.

The voyage up into Bering Sea was made in 14 days and the engines were not stopped until the vessel anchored off the mouth of the Kuskoquim River to wait for the fog to lift. During the trip an average speed of 7 knots was maintained on less than eight (8) bbls. of fuel oil per day.

While navigating the river up to Bethel, the engine was maneuvered continually, first ahead and then astern, on account of the shoal water The ability of the engine to stand up under this prolonged test of its reversing qualities establishes the claim of the surface-ignition engine to reliability in that respect.

On the return voyage the "Ozmo" was driven ashore in a heavy southeast gale and the vessel pounded on the beach for 24 hours. At the time it looked as though she was on her last voyage, but the bilge-pumps attached to the main engine were able to take care of the water which leaked through as the hull became badly strained.

After a round trip of over 5,000 miles, the vessel arrived at Seattle within two months from leaving that port without having had a particle of engine trouble. The vessel was drydocked and the hull repaired ready for another trip.

According to her chief-engineer, Mr. J. P. Browner, there was not an expense of a single cent for engine repairs for this voyage and, as far as he knows, not more than fifty dollars has been spent for repairs since the engines were installed in 1915.

The "Ozmo" is an 800 tons deadweight vessel which prior to conversion to a motar auxiliary was the schooner "Hugh Hogan." She was built in 1904 at Marshfield, Oregon, and is 170 ft. long, 38 ft. 8 in. broad, 9 ft. 8 in. deep, and is powered with a 320 h.p. Bolinders engine. She is now owned and operated by the Northern Commercial Company of Seattle, Wash.

Mr. Browner narrates an interesting incident which happened on this last trip. While passing the Swiftsure Light, near Seattle, the four-masted tops'l schooner "Mary E. Foster" was sighted. Due to the absence of wind this vessel, handicapped by the lack of auxiliary power, was drifting. The engineer of the "Ozmo" remarked to the captain that if the "Foster" were powered she would be able to get into port. The captain, himself an old steam man who did not have a great deal of confidence in oil-engines, said that she was a sailing ship so did not require any power. Later the "Mary E. Foster" went aground at Port Angeles.

A NEW MOTORSHIP YARD

A 1600 to 1800 ton motor-auxiliary wooden sailing-ship is being laid-down at the new shipyard of the North Eastern Shipbuilding & Transportation Company at Freeport, Maine, who have their offices at Portland, Maine. This vessel is the first of three sister craft—each 200 feet length by 40 ft. breadth, from designs by Tams, Lemoine & Crane. A 500 h. p. Diesel engine will be installed in each vessel. The General-Manager of the yard is Mr. Morris Whitaker, Naval-Architect, of Nyack-on-Hudson, N. Y.

ANOTHER EXHIBITION IN ENGLAND

An International Motorboat and Marine and Stationary Engine Exhibition is being held at Olympia, London, W., from March 12th, to 20th, 1920, inclusive, under the auspices of the Society of Motor Mfrs. and Traders, Ltd., 83 Pall Mall, London, S. W.

"MAZATALAN"—A NEW AMERICAN STEEL MOTORSHIP

Now under contruction on the Pacific Coast of the U. S. A. is a twin-screw steel cargo and passenger motorship of 1,500 tons d.w.c. This vessel is the "Mazatalan," building for the Californian-Mexican Steamship Co. of Los Angeles, Cal. by the Long Beach Shipbuilding Company to the highest classification of the American Bureau of Shipping. Her dimensions are as follows:

Length overall	180′
Length b. p.	165′
Breadth	34′
Depth	20′
Engines	Winton Diesel
Power	700 b.h.p.
Engine speed	225 r.p.m.
Speed expected	10 to 11 knots

Without the lines of the ship before us, we cannot to say for certain, but we presume she will be moderately fast-lined, as she will have accommodations for 84 passengers. Nevertheless, we consider that she is a little underpowered and that the owners would have eventually been more satisfied had they arranged to install two 500 b.h.p. motors instead of two 350 h. p. engines. The daily consumption of fuel would have merely been increased about 25 barrels to 35 barrels. As it is, we do not anticipate that she will be able to maintain an average of more than 9½ knots when loaded. But, our opinion is by no means infallible, so we may be wrong in our surmise. She is expected to start on her first run within a few weeks, so it will not be long before results show what she can do.

Her machinery will consist of the four-cycle and Winton Diesel engines of the four-cycle type, and they will be coupled direct to the propellers. There will be three cargo-holds served by electrically operated winches. In an early issue we hope to publish drawings and complete details of this vessel.

ARMSTRONG-WHITWORTH TO BUILD SULZER MARINE DIESEL ENGINES

In a communication to us, Sir Wm. Armstrong-Whitworth & Co., Newcastle-on-Tyne, who are one of the largest shipbuilders in England, state that realizing the great future of the Diesel engine for merchant-ship propulsion they have entered into an agreement with Sulzer Freres whereby they acquire a license to manufacture and sell in Great Britain and the Colonies the latest types of Sulzer two-cycle marine-engines.

It has been decided to adopt, they say, the two-cycle principle on account of its proved reliability and efficiency, its high ratio of horse-power to size and weight, and its ability to work continuously on Californian or Mexican crude-oils of high sulphur and asphalt content, which are the cheapest fuels at present on the market.

Marine and stationary Diesel-engines aggregating over 600,000 shaft H. P. have now been built by Sulzer Freres on the two-cycle principle.

The vast resources of Armstrong's great works and their achievements are known to the whole world, and the news of their latest venture will be a matter of considerable interest to shipowners and others, and should stimulate the ordering of motorships in this country.

Now—Messrs. Armstrong Whitworth are experienced in the construction of steam turbine and reciprocating-engined ships so American shipbuilders may "sit up and listen" when we tell them that this conservative British firm claims that the development of the marine Diesel engine will undoubtedly prove an important factor, as boats equipped with machinery of this class have far more cargo-capacity, weight for weight, than vessels driven by means of Steam-Turbines or Reciprocating steam engines in addition to a greatly increased radius of action.

Important Mercantile Marine Exposition Next April

Exhibition to be Held at Grand Central Palace, New York City

TO arouse the people of the entire country to take a voting and investing interest in the American merchant marine and thus establish the maritime independence of the United States, a series of demonstration, nationwide in scope but centering in New York, will be held next April 12-17 under the designation of National Marine Week, it has been announced by the National Marine League under whose auspices the program has been arranged. Parades, dinners, exhibits and an exposition of the largest collection of ship models ever gathered in America will be features of the week's ceremonies which will be opened by Secretary of Commerce Joshua W. Alexander, Chairman John Barton Payne of the U. S. Shipping Board, Senator Wesley L. Jones, Chairman of the Senate Commerce Committee, Hon. William S. Greene, Chairman of the House Merchant Marine Committee and others prominent in national maritime affairs. The co-operation of all who have the interest of the American Merchant Marine at heart is asked for by the League.

The time has come for the nation to realize the pressing economic importance of national maritime independence. American cargoes, mails and passengers must be carried largely in ships built, owned, operated and manned by Americans in ships equipped and repaired by American industry and classified and insured by American companies. It is a matter of the greatest importance to the inland as well as to the seaboard states that our merchant marine be put upon a permanent basis of healthy development.

As it is vitally important to impress into shipowners and the general public the remarkable value of the economical heavy-oil engine to the American merchant marine, we trust the entire domestic heavy-oil-engine building industry will be represented by means of photographs, models, and where possible by actual engines, although of course, only small motors could be exhibited.

The tentative program for National Marine Week follows:

Monday, April 12: Inaugural luncheon in New York harbor abroad a ship built, owned, operated and manned by Americans at which the ceremonies will be opened by Government officials. At night: formal opening of The National Marine Exposition by Chairman Payne of the U. S. Shipping Board.

Tuesday, April 13: Merchant Mariners' Day, Devoted to the officers and men of the American Merchant Marine. Special features to aid in recruiting American boys to the seafaring professions.

At night: The annual dinner of The National Marine League in New York, at which Secretary of Commerce Joshua W. Alexander will be the principal speaker, subject "The Merchant Marine and Foreign Trade."

Wednesday, April 14: Shipbuilding Day. Launching of ships by electric buttons pressed from the floor of National Marine Exposition. Films and lectures of popular and technical interest.

Thursday, April 15: Travel Day. "Travel in American ships "featured under the auspices of The Travel Club of America.

Friday, April 16: Oil Fuel and Engineering Day. Special features in connection with American maritime inventions, propulsive and auxiliary machinery.

Saturday, April 17: Inland Waterways and Harbors Day. Demonstration parade in New York City, reviewed by Government officials.

The League's uncompleted committee for National Marine Week celebration includes the following:

Secretary of Commerce Joshua W. Alexander.
A. C. Bedford,
August Belmont, Chairman of Board of Trustees of League,
George J. Baldwin,
R. T. Crane,
Holden A. Evans,
George S. Gaston,
Admiral Albert Gleaves, Commander of U. S. Asiatic Fleet,
Oscar L. Gubelman,
W. Averill Harriman,
Alexander J. Hemphill,
Wm. E. Hunphrey, Member of Gallinger Merchant Mar. Comm. 1905,
Edgar L. Marston,
Judge John Barton Payne, Chairman U. S. Shipping Board,
Gordon S. Rentschler,
P. H. W. Ross, President of the League,
Benjamin Rush,
D. E. Skinner,
Frank Waterhouse and John N. Willys.

Captain Felix Riesenberg, seaman, officer, engineer, explorer, author and editor successively, is in charge of the program of National Marine Week for the League. Working with representative committees of maritime men, Captain Riesenberg will soon begin a canvass of the American maritime world for house flags, maritime relics, historical objects, ship models, etc., to be shown in connection with the National Marine Exposition and various library and art exhibits. Suggestions sent to the headquarters of the League, 268 Pearl St., New York, will be welcomed.

Converting Old Sailing-Ships to Auxiliary Oil-Engine Power

Interesting Work at the Morse Dry Dock & Repair Co.'s Yard

By Joe. L. Murphy

The ship "Alejandria" re-built by the Morse Dry Dock Co., after 20 years on a reef. It is likely that an auxiliary oil engine will be installed.

NOT long ago a four-masted schooner made a 3000 mile run from Para, Brazil to New York in 20 days. What with halts by the way, the regular steamers in this trade have made little better time than this. Now comes the sailing vessel "Alejandrina" which after laying for 20 years on a reef, celebrated her rehabilitation by making a 9000 mile run to New York in 92 days. Calm weather,—too calm to fill the sails of the "Alejandrina" and hasten her voyage, was responsible for her slower time. It appears she was built by Mordaunt & Co., at Southampton, England, in 1886 and was named the Andrina. Her owners were E. F. & W. Roberts of Liverpool when, about 20 years ago, she stranded near Punta Arenas and became so firmly embedded in mud and sand that she could not be ground out the means then at hand. Nevertheless, the question arises, "Are sailing-ships to be transformed into things of life—as profitable as the famous packets?" What with Diesel and other oil-engines, this may come to pass.

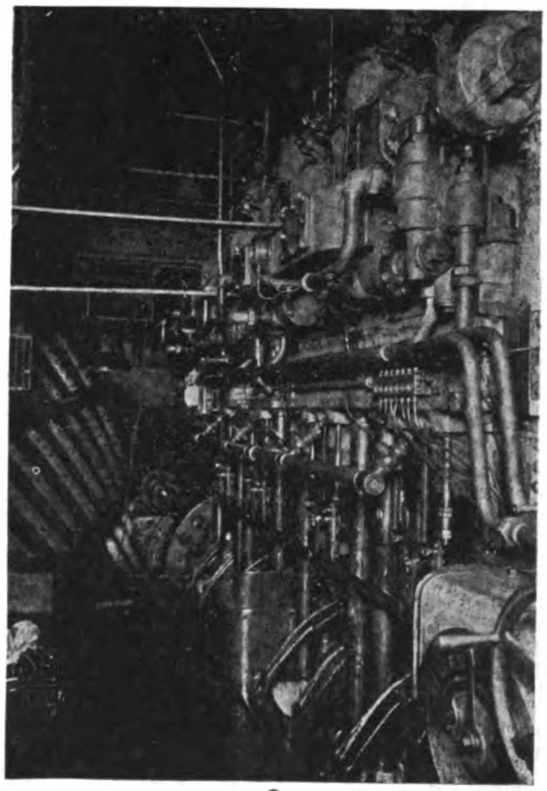
The submarine peril has passed and the sailing-ship, once the favorite prey of the ruthless U-boats, may come into her own. She had been tempting prey for the subs. She was slow. She could not dodge and ziz-zag as a steamer could. There were difficulties in camouflaging her, and she was an easy target.

But now—when cargo and passenger carrying steamers are adapting a policy of reconversion from coal to oil-burners,—Diesel and steam—all with a view to economy and profit;—the sailing ship, with its small crew, with the absence of heavy fuel costs and with other economical features, seems to enjoy prosperity.

Slower, surely, but every trip a profitable one. No strict schedule to be carried out regardless of whether or not cargo and passenger capacity is at maximum. Slower, of course, but only one who has beheld a full-rigged ship at sea can hope to see a prettier sight, she is to the steamer what the thoroughbred horse is to the trolley-car, slower but infinitely better to look upon.

A search of the seas would find an Italian ship known as the "Spica," which, for 41 years, was a sailing-vessel. Boarding her one would now find her equipped with three oil-engines of different makes and types, and a fuel capacity for a 15 days' cruise. The "Spica," equipped as she is, left the Brooklyn, N. Y., yards of the Morse Dry Dock & Repair Co. vigorous and powerful—and after 41 years under sail.

(Continued on the next page)



Southwark-Harris Diesel engine of the auxiliary "Sans Guiseppi"

Of the engines installed in this ship, the main propelling unit is a Southwark-Harris two-cycle reversible type Diesel. It has a brake power of 385 and an indicating horse-power of 625. The auxiliary engine used to drive the air-compressor is a Gelowsky, surface-ignition marine type. The bilge-pump is driven by a Novo single-cylinder Diesel-engine.

The "San Guiseppe", also an Italian sailing-ship, was fitted out by the Morse Company in much the same manner, the propelling Diesel engine also being a Southwark-Harris.

Another example of almost complete conversion and one with considerable interest, is that of the "Nepthis", an old Brazilian ship, which parted her line while being towed from Rio de Janeiro to New York, lost at sea, she was later found by a United States revenue cutter which attempted to tow her. The task proved futile and the "Nepthis" again became a derelict until she was picked up by the "Davy Jones." This boat, too, was having its trouble when Morse tugs grappled with the "Nepthis" and towed her to the yard of the Morse company where she was fitted from keel to mast-head.

And now the "Powhatan," "Avalon" and the "Huron." The former, a bare hulk, battered badly, is assuming her natural lines and the fittings of a first class vessel. The "Avalon," with her bow and stern severed that she might pass through the locks of the Lachine canal, above Montreal, is regaining her normal length and receiving beautiful appointments including two dance halls, de luxe cabins and woodwork beautiful and costly, and so arranged as to obscure all piping and wiring.

A modern ship repair plant may be likened to a ship building company, because, being modern, it is equipped to re-create an apparently worthless hulk into a first class power ship. Its modern facilities and equipment permit the ship repairer of the present day to assume a contract that ranges from transforming an old-time sailing vessel into a vigorous, modern ship, or dismembering and disemboweling a valuable vessel to convert it into the last word of ocean navigation non-rolling and a fuel-oil burner.

The Morse Dry Dock & Repair Company of Brooklyn, N. Y., is perhaps one of the greatest exponents of modernness in ship surgery and alterations. From the very nature of the work this company has done and is doing, it ranks as one of shipping's biggest assets. It keeps vessels space with the growth and improvement of navigation. No ship is obsolete, out-of-date as long as its keel is even and its ribs are sturdy. In the Morse yards, it may take on all the newer features that might be embodied in a ship coming direct from the builder.

Then there are the battered, helpless wrecks and derelicts that have escaped or have been reclaimed from Davy Jones' locker. With the help of the ship repairer these may cruise again as did the "Florida" after she rammed the "Republic" and had 30 feet of her plates and frames jammed into five feet; as did the "Powhatan," rammed and sunk in a collision in Chesapeake Bay, and after being submerged for six months comes to the Brooklyn yards of the Morse Company to be fitted as a first-class excursion steamer.

BOOK REVIEW

Marine Oil Engines, Their Construction, Management and Maintenance, by W. D. Martin

Published by James Munro & Co., Ltd., Glasgow, Scotland

This Handbook, which just now comes from the print, in its second revised and enlarged edition, deals with a general description of marine oil-engines of the ignition, semi-Diesel and Diesel types. To the description and instruction of operation for these various types of engines there have been added a few chapters of value to the motor engineer, such as, Board of Trade Regulations re Motor Certificates in England and Lloyd's Rules for Construction and Survey of Diesel Engines and their Auxiliaries. Since the book is dealing with marine motors in general, these rules should include those of other motors than of the Diesel type.

A very valuable chapter of questions and answers is presented to the engineer who is preparing for his license. Much literature of this kind is available for the marine steam engineer, but hardly any for the motor engineer, and, therefore, this chapter will be well appreciated and it is hoped that the author will eventually expand this chapter still more. However, we find two answers on which we hardly can agree with the author. On page 181 answer 38 reads:—

"With steam engines we have pressure behind the piston the whole length of the stroke, but with the oil engine the pressure or force is instantaneous, or nearly so, and we look to the flywheel to carry the parts round until the next explosion or combustion takes place. The gas cannot be used expansively as in a steam engine."

This answer does not cover the actual facts since the power of expansion of the gas is transformed into work during practically the entire length of the power stroke as in the steam engine. The difference of the working of the oil-engine in this respect lies in the fact that on a single acting four-cycle engine the fly-wheel is doing the work during three strokes out of four and on a double acting, two-cycle engine the flywheel is doing the work during every upstroke of the piston. Furthermore, the gas of heat engines is not only used expansively in one cylinder but there are also running experimental "compound" engines.

The answer 53 is not correct because the author neglects first that the volume at the beginning of the compression is V V, and not V, second the relation of pressure and volume is expressed by the formula

$$\frac{P}{P_1} = \left(\frac{V_1}{V}\right)^n$$

and third, in this formula the pressure must be expressed in absolute pressure. Assuming the coefficient in this case equal 1.3, the solution of this question will read

$$\frac{P}{P_1} = \left(\frac{V_1}{V+V_1}\right)^{1.3} \quad \frac{15}{60+15} = \left(\frac{V_1}{12+V_1}\right)^{1.3}$$

with the result of $V_1 = 4.9$, and not 3 as stated, by the author.

There is one special chapter entitled "War Developments in Oil Engines" under which heading the reader might expect a numeration of the great progress of the oil engine during the war but author describes only in this chapter, though in a very detailed way, the results of a Samuel White two-stroke Diesel engine.

We feel sure that the author will complete and modify these few items in the next edition, but, otherwise, we must state that this book seems to us a good book for general information on the operation and handling of oil engines with special reference to preparing for a license of motor engineer.

WHAT HAPPENED TO THE "BREMEN." LATEST INFORMATION REGARDING GERMANY'S "UNTERSEE" BOATS:—

PROBABLY the most complete tabulated information regarding the German war-built submarines, appears in a recent issue of the London "Engineer" but the article and tables are disappointing in that the horse-powers are not given, the information otherwise being most complete. The total number of submarines is not the same as that previously published since the Armstice, the number now given being 372 of 209,046 aggregate surface-displacement tons, instead of 765. Also, the total losses are now given as 202, leaving 170 submarines on Nov. 11th, 1918. Sixty-five more were on order. In view of the variance of issued figures we suggest that the U. S. Navy Department issues an official statement.

These 372 boats mounted between them 401 guns, viz., thirty-three 5.9in., one-hundred and ninety-two 4.1in., one-hundred-and-sixty-six 3.4in., and ten 5cm., or 4-pounders, together with 1492 torpedo tubes and 2779 torpedoes. They carried 2314 mines, and their complements numbered 11,673 officers and men.

We note the following large submarines:—U. 117; U. 118; U. 122; and U. 123, each of 1164 tons surface-displacement with one 5.9in. gun and twenty-four 19.7in. torpedoes. The U. 135 of 1175 tons displacement with 5.9in., gun and fourteen 19.7in., torpedoes. The U. 139 of 1930 tons displacement with two 5.9in. guns and nineteen 19.7in. torpedoes. She was named "Schweiger" after the name of the officer who sank the "Lusitania." The U. 151 to U. 157, which were seven craft of 1510 tons displacment with two 5.9in. guns and eighteen 19.7in. torpedoes. All these were completed in 1917.

In 1918 U. 119; U. 120; U. 124; and U. 125 and U. 126, all of 1164 tons displacement with one 5.9in. gun and twenty-four 19.7in torpedoes. Also the U. 136 of 1175 tons displacement with one 5.9in. gun and fourteen 19.7in torpedoes. And the U. 140 and U. 141 each of 1920 tons displacement with two 5.9in. guns and twenty-four 19.7in. torpedoes. Also the U. 136 of 1175 tons displacement with one 5.9 in. gun and fourteen 19.7in. torpedoes. And the U. 140 and U. 141 each of 1930 tons displacement with two 5.9in. guns and nineteen 19.7in. torpedoes. Finally there is the U. 142, a submarine-cruiser of 2158 tons, 6,000 b.h.p., with two 5.9in. guns and nineteen 19.7in. torpedoes.

This gives 22 submarine-cruisers of over 1100 tons surface-displacement aggregating 35,494 tons with 31 guns of 5.9in. bore, and carrying a total of 446 torpedoes each of 19.7in. diameter. Truly a formidable fleet to have lurking beneath the waves in wait for merchant ships.

The facts concerning the mystery of the submarine cargo-carrier "Bremen," sister craft to the "Deutschland," are given. The nameship made two successful voyages across the Atlantic, and seven more boats were built to the same design. One of them, the "Bremen," left Germany in the autumn of 1916 for an American port, but never arrived. The vessel was lost with all hands in attempting to make a "crash dive" necessitated by the approach of a British patrol. Before the remaining boats of the "Deutschland" class were ready America had declared war, and their occupation was gone. They were at once altered into combatant vessels, two torpedo-tubes being built into the bows and a pair of 5.9in. guns mounted before and abaft the conning-tower.

Various naval authorities are still at loggerheads over the value of the submarine in modern naval warfare, because of the better means of combating this hidden foe. But, what would have happened had Germany 500 submarine-cruisers in service in August 1914. We wonder if "Kaiser Bill" would have made his throne at Washington, or on the fiftieth floor of the Woolworth Building, where he could have smugly surveyed the greatest city of the world.

OPERATION OF A LARGE DIESEL-DRIVEN TANKER.

(*Continued from Page* 128)

these carefully before coming to any conclusion. The causes of the stoppages are given as follows:—

			Engine
(1)	¾ hr...	To renew joint on exhaust valve box	Starboard
(2)	1¾ hr..	For air compressor	Port
(3)	2 hr....	To exchange exhaust valve..	Starboard
(4)	¾ hr...	To examine crank shaft.....	Both
(5)	30 min.	To examine bottom ends....	Starboard
	20 min.	To examine bottom ends....	Port
(6)	3 hr....	For broken slipper guide bolt	Starboard
(7)	½ hr...	To tighten piston bolts......	Port
(83)	2 hr...	To renew two broken piston bolts	Port

We much regret, says "The Engineer," that we have to admit that we have not been able to obtain such full explanatory notes on all these stoppages as to appraise them justly, and a good deal must be left to surmise. We can say, however, that Nos. 1, 3 and 6 need not have caused stoppage of the engine at all if it had been thought necessary to keep it running, as the particular cylinder affected could have been cut off without interfering with the working of the other five. In No. 6 the slipper-guide bolt was connected with the water service and on that account would have necessitated either the stopping of the engine or the cutting out of the cylinder. Nos. 2, 7, and 8 were perhaps the most disabling casualties, and probably called for the immediate stoppage of one engine, whereas it is important to note that only one engine had to be stopped at a time, and all the other stoppages were of such a nature that not only could the trouble be rectified in a short time, but the engineer could to a very large extent choose his own time for the stop to suit the bridge. It is only the stop which puts the ship completely out of control and which occurs without notice to, or consultation with the bridge that causes real anxiety * * *

It is satisfactory to note that the records show no cases of fracture of any important part of the main engine; *but the special point which we set out to discover when we undertook these investigations was the amount of overhaul and renewal necessary at the end of a voyage. We think that the record which we published, extending over eleven months and a distance of 50,700 nautical miles for a five-year-old ship is very good evidence that this is not a point which can be raised against the Diesel engine, in spite of the twelve cylinders, and especially having in view the extensive boiler refit which would be becoming due in a corresponding steamship.* A large part of the work appears to have consisted of cleaning air-compressor valves and filters, while two points which have always suggested difficulty—the pistons and the exhaust valves—seem to have required extraordinarily little attention.

A study of the log of a voyage from Singapore to Bordeaux shows that the revolutions averaged 110 per minute, and that the ship made a speed of 8.61 knots fully loaded on a consumption of 6.98 tons of fuel per twenty-four hours for 37½ days.

MR. H. R. CRAWFORD'S ADDRESS WANTED

Will Mr. H. R. Crawford, Chief-Mach. Mate U. S. S. "Kemah," care Postmaster, N. Y., kindly send us his present address, as copies of "Motorship" sent to the above address are being returned by the Postmaster.

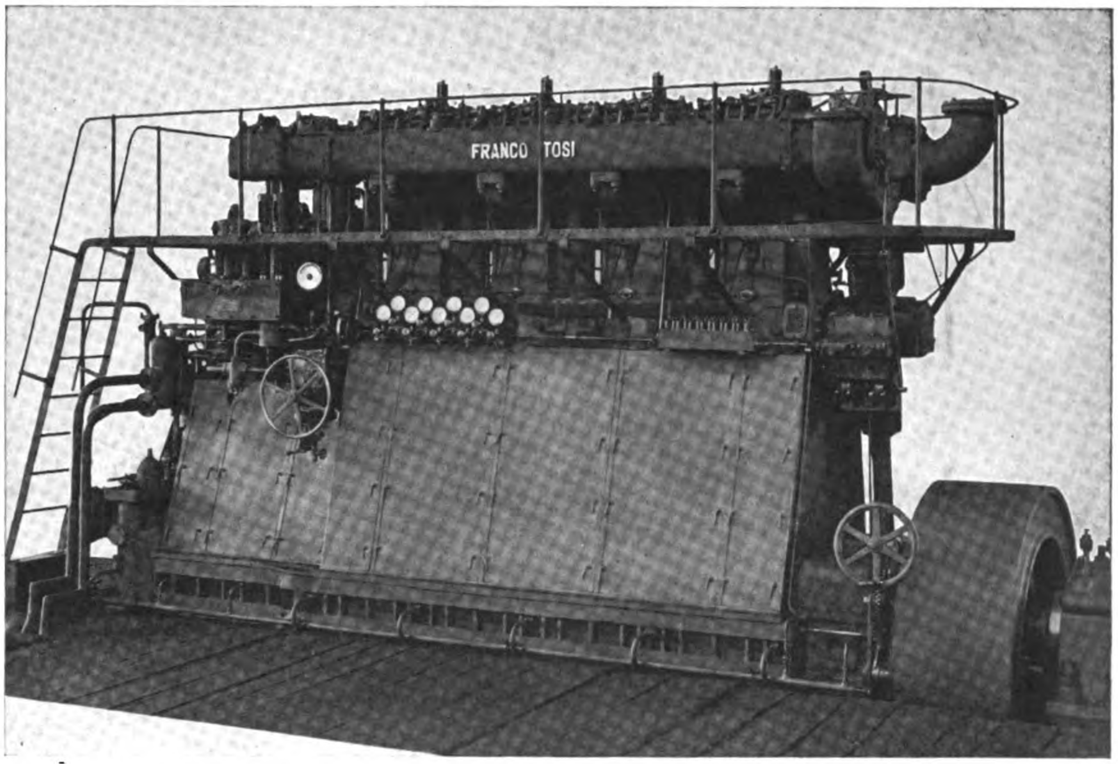
LARGE TOSI DIESEL ENGINE MOTORSHIP

Messrs. Franco Tosi of Legnano, Italy, have written to us with reference to our issue of March, 1919, where we published a reference to a motorship named "Blanche" owned by Messrs. Quaglia & Galdini of Genoa, on page 27.

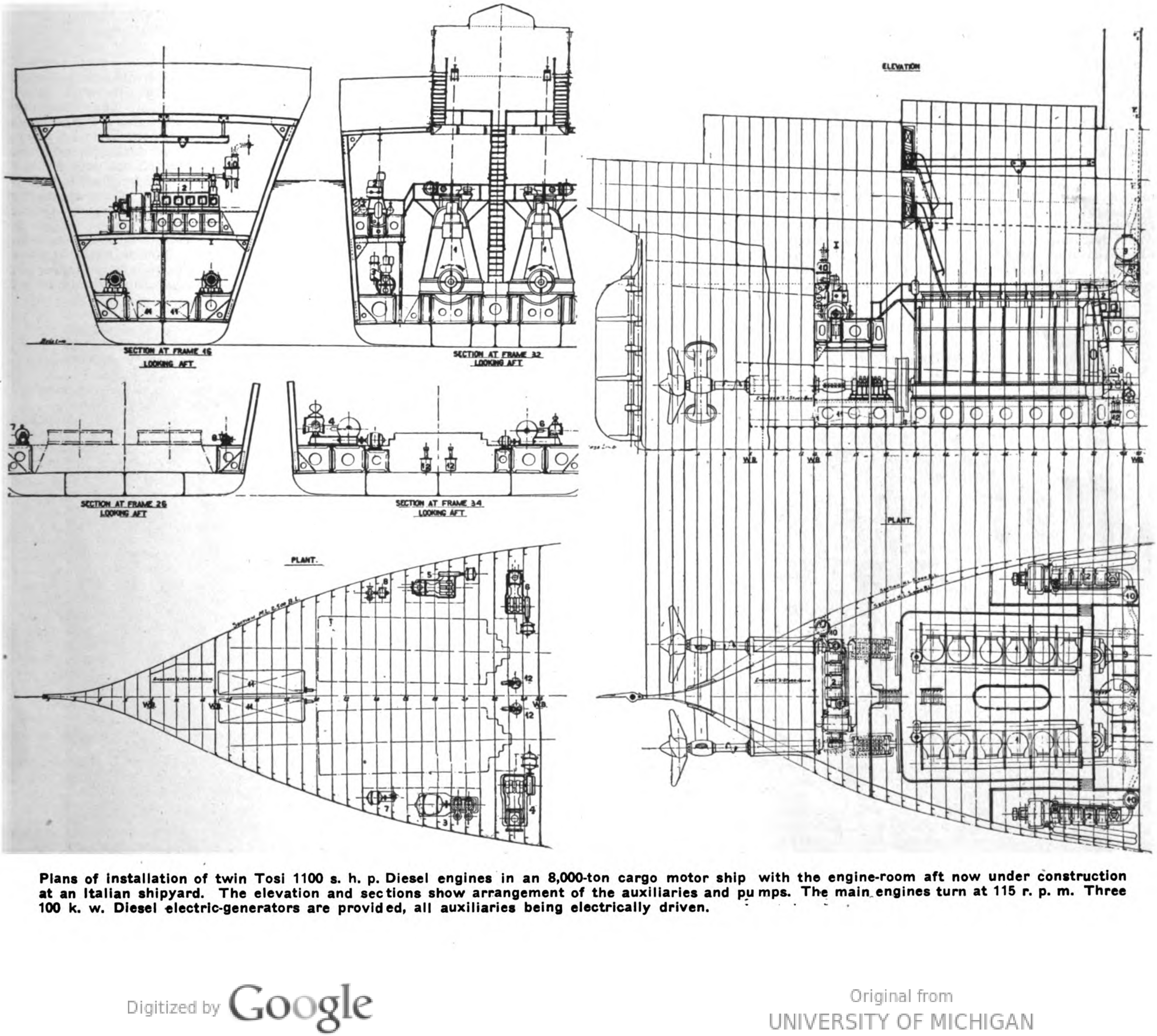
In this paragraph it was stated that the engine of this vessel was built by P. Kind & Co. of Turin. This, however, is an error as the firm in question only supplied the auxiliary machinery, the main propelling Diesel-engine having been built and furnished by Franco Tosi of Legnano. We are glad to make this correction.

On this page is an illustration of the new 400 shaft H. P. merchant-marine type Tosi Diesel-engine. This is of interest as a small marine type Tosi Diesel engine is now building at the works of the Manitowoc Shipbuilding Co., Manitowoc, Wisc., under Tosi license. Also the United Engineering Works of San Francisco have taken up the construction of this excellent Italian oil-engine.

We also give some interesting plans of an 8000 tons d. w. c. cargo motorship now under construction in Italy in which two 1100 shaft H. P. Tosi Diesel-engines are being installed. We anticipate the trials of this vessel with considerable interest as her machinery consists of the very latest design of Tosi marine engine. As it is well known, Messrs. Franco Tosi, for many years, have been builders of marine steam-turbines, but realizing the wonderful economical advantages of the heavy-oil internal-combustion engine, they have made considerable progress in the latter class of machinery and are encouraging its use in the Italian merchant marine.



A 400 shaft h. p. Tosi merchant marine Diesel engine



Plans of installation of twin Tosi 1100 s. h. p. Diesel engines in an 8,000-ton cargo motor ship with the engine-room aft now under construction at an Italian shipyard. The elevation and sections show arrangement of the auxiliaries and pumps. The main engines turn at 115 r. p. m. Three 100 k. w. Diesel electric-generators are provided, all auxiliaries being electrically driven.

Machining Diesel Engine Crankshafts

Midvale Steel Company Adopt Ingenious Danish Tool. Roughing-Out Operation Reduced To One-Tenth of Usual Period

FOR a considerable time past "Motorship" has had under preparation an article on the novel machine-tool employed at the Diesel-engine works of Burnmeister & Wain, Copenhagen, Denmark, for the machining of large crankshafts, but in view of certain negotiations taking place in this country we withheld publication by request of the owner of the American rights. The rights for this machine since have been secured by the Midvale Steel Co., who now have some of these tools in operation, and by its use the cost of construction of finished crankshafts is greatly reduced. In fact, the time occupied in roughing-out a complete forged crankshaft having been cut down to one-tenth of the period formerly required for such an operation.

Incidentally Krupps of Essen, Germany, who furnishes all of the heavy crankshafts to the daughter company Fried Krupps Germania Werft, Kiel-Garden, paid a high price for the privilege of building and using the machine which has effected this improvement, also the John Brown works of Sheffield, who bought the English Patent.

Our own knowledge of this machine was first made early in 1912, through the medium of Mr. R. W. Crowly, of Wellman, Seaver & Morgan & Co., Cleveland, Ohio, who made an exhaustive study of the tool at that time and to whose courtesy we are indebted for the excellent description. While for all these years we have been in possession of its merits and technical details, we did not personally see one of these tools in operation until last September when we were in Copenhagen. Seeing the tool in actual operation impressed us more than ever with the importance of its engineering and commercial features.

There is an interesting story attached to the interim period during which arrangements were made to build this machine-tool in the U. S. A. John M. Larsen, of New York City, a well-known American engineer and manufacturer, during a tour in Europe also saw this extraordinary machine-tool in Copenhagen. It is the invention of Mr. Christen Overgaard, an eminent Danish engineer, then Works-manager of Burmeister & Wain Diesel Engine Works, and later promoted to Technical-Director of Chief of the Works. Mr. Larsen saw great possibilities for this tool in America, and opened negotiations that resulted in his outright purchase of the United States patents. After his return to America, he was determined to see that this important invention was utilized to best advantage of the engine builders of America, and he concluded that Midvale Steel Co., as expert steel makers direct from the ore and as eminent producers of heavy high-grade forgings, was one of the most logical firms to take over this important improvement in heavy crankshaft manufacturing. The Midvale people promptly realized the importance of the invention and purchased the U. S. patents from Mr. Larsen together with two machines that Mr. Larsen had put under construction in this country. The illustration here shown is of one of the machines delivered by Mr. Larsen to Midvale.

Six distinctive stages in the manufacture of a crankshaft by the new method may be defined, and these are all shown in Figure 1, relating to a particular shaft, the forged state being illustrated first. The shaft is then subjected to the first operation in the new machine, the material between the cranks being removed, this stage being completed in 18 hours, inclusive of the time necessary to fix the shaft in the machine. It appears then as in the next view, and after torsion in the forge is brought to the condition pictured below. When the journals and the outer cheeks of the webs have been roughly turned, the shaft is again put into the new machine, and in 40 hours the crank-throws are completely finished, with only 2 mm. left on the inside faces, and only 2.5 mm. on the crankpins, for the finishing cut. The shaft is then in the state indicated in the fifth sketch demanding a finish in the ordinary manner to reach the completed condition.

By the elimination of the operations carried out in the drilling, planning, and slotting machines and without a saw, the crankshaft of Figure 1 is roughed-out from start to finish in one-tenth of the time necessitated by previous methods, considerably reducing the total time necessary for the production of a crankshaft, and thus proportionally diminishing the costs of that production. A complete forged crankshaft can be made in the same space of time as a built-up-one, and still quicker when there is question of a shaft with but one crank. The shop crane is called less into requisition, and instead of the approximately 4,000 square feet of floor space occupied by the various machines, which were previously needed for the different operations, the new machine that replaces them for this work takes no more than 236 square feet. These are not insignificant advantages, and since connecting-rods and other similar pieces can also be dealt with rapidly the utility of the design is notable. A single milling-machine adapted not only for the roughing-out operations above described, but also for any use whatever in shops where steam or Diesel-engines are constructed is now being turned out by the same firm.

A general view of the machine is given by Fig. II, wherein may be seen a similar shaft to that dimensioned in Fig. I. The robust character of the whole is evident. Direct-coupled motors of

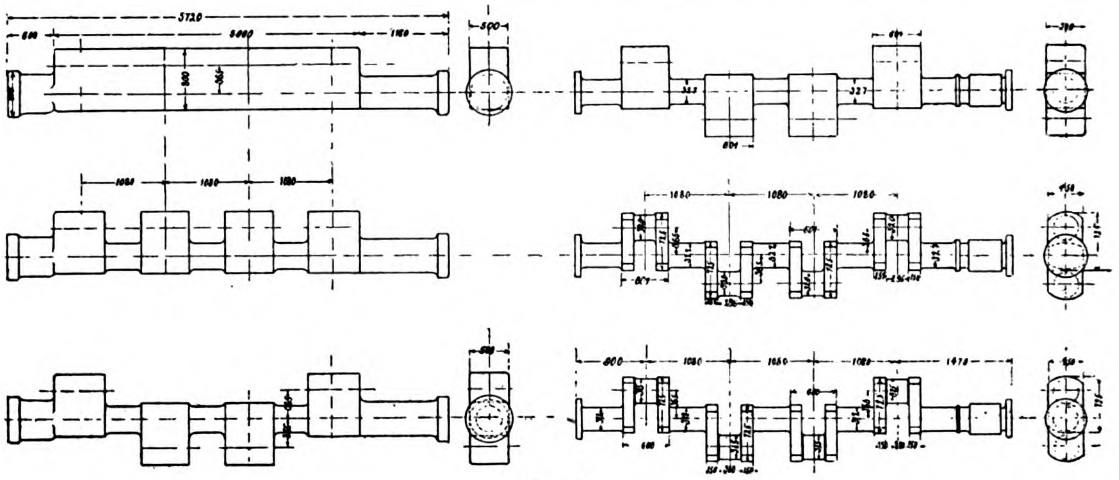


Fig. 1

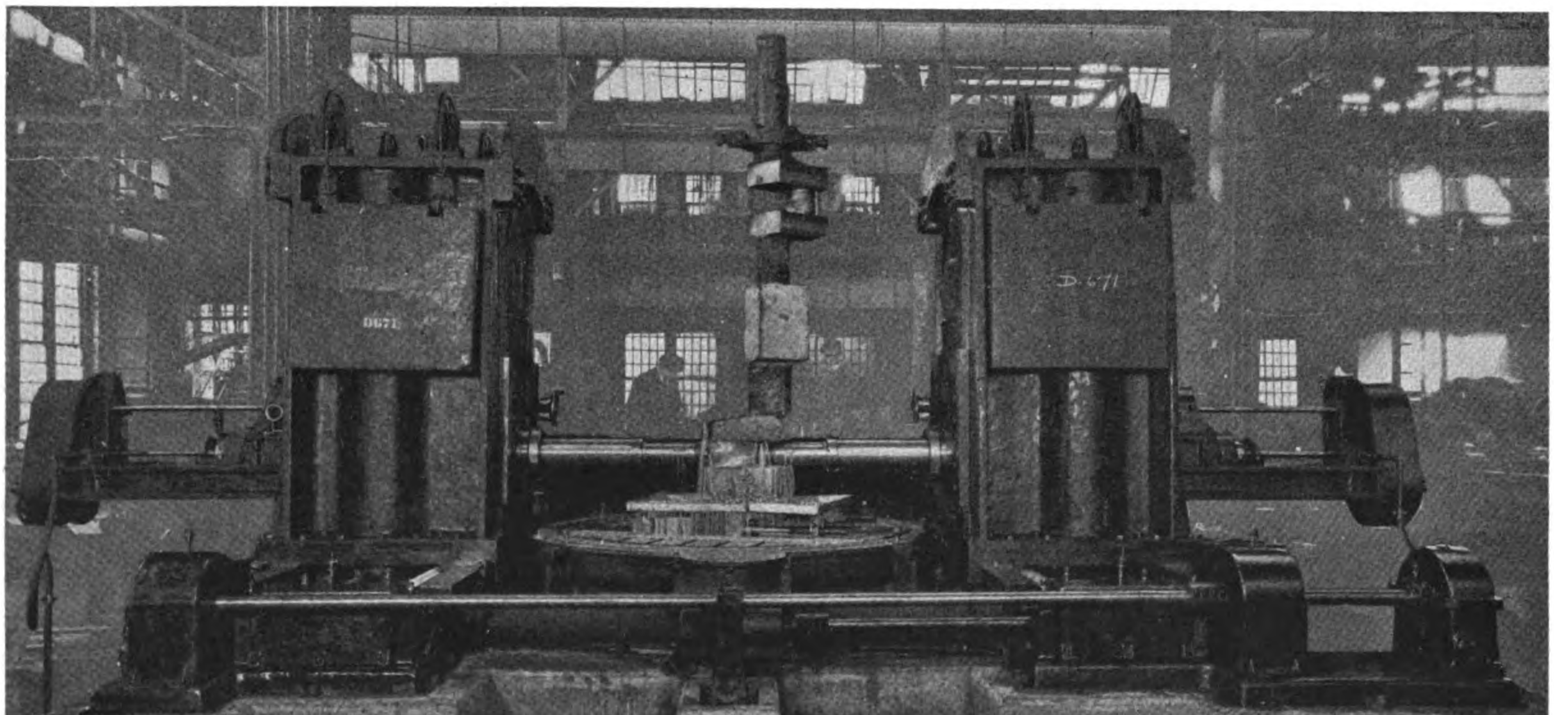


Fig. 2. The Burmeister & Wain crankshaft machine-tool at the Midvale Steel Works

about 50 h. p. are used, and the weight complete is in the neighbourhood of 115 tons. The details are shown in Fig. III, which gives the plan and the elevation of the table and of one of the housings, the second of the latter being omitted because it is identical with the one illustrated in the drawings.

In the middle of the bed-plate and above a pit is mounted the work table to the underside of which is bolted a large toothed ring, by means of which the table is turned during the cutting. The driving power is taken from an electric motor through helical gear-wheels to the prime shaft, and thence through bevel-wheels, selected by dog-clutches for either direction of rotation to the wormshaft, and carried on by double-reduction wheels. On the table there is a clamp to hold the crankshaft in a vertical position. This clamp consists of two parts which can be shifted diametrically across the table in such a manner that the crankshaft can be rotated about a centre which is the centre of the table and at any radial distance therefrom. It is of course possible to rotate the crankshaft round a centre common to itself and to the table. The clamp is tightened by four bolts and can be moved across the table by means of a rack.

Guides are formed upon the bed-plate on both sides of the table to take the housings of the cutting spindles with their motors and gearing. Each housing is moved laterally by a traversing screw,

The form of cutter favored may be seen in Fig. II, but is not shown in the drawings. Any form can be used, but the type illustrated enables large quantities of metal to be removed and the turnings can clear themselves between adjacent cutters. Since it is chiefly steel which has to be cut in this machine and provision of soap water to the tools must be full and ample. For this purpose a pump is furnished to force lubricant from the pit under the work-table through flexible tubes to the hollow cutter spindles and so to the tools. The pit is primarily for the reception of the lower portion of the crankshaft, it being desirable to machine the shaft as near as possible to the clamps. After the first crank has been machined the shaft is released and gripped again between the second and third crank, after which it is turned about and the machining is started from the opposite end. If the crank-throws are more numerous the machining will proceed further before the shaft is turned about. The position of the shaft shown is not adopted in practice, but is illustrated in order to make the size of the shaft plain. The use of this pit as a reservoir for lubricant is subsidiary.

Referring back to the diagrams of the operative stages in the production of a crankshaft in this machine, the manner in which the work is clamped for the different cuts may be briefly described. To cut out from the forging the material between the cranks, that is, turn roughly to the journals and the machine from the side of either housing, etc., and will suggest the diversified operations which can be carried out. Not for a long time has such an important machine-tool been evolved for employment in engine shops.

Machining Times

Maximum speed of milling spindle 105 rev. per min.
Minimum speed of milling spindle 12 rev. per min.
Maximum axial traverse of milling spindle....36¼ ins.
Maximum traverse of milling head......51⅛ ins.
Maximum lift of milling head..........39⅜ ins.
Maximum axial feed of milling spindle..................... 7 ins. per min.
Minimum axial feed of milling spindle .... ⅜ in. per min.
Maximum traverse feed of milling head .... 8½ ins. per min.
Quick return traverse feed of milling head (both ways) ....38 ins. per min.
Maximum lift feed of milling head ....3¾ ins. per min.
Minimum lift feed of milling head .... 1⅝ ins. per min.
Maximum table speed ......0.24 rev. per min.
Quick return table speed (both directions) ....0.67 rev. per min.

When in the Burmeister & Wain factory last year we ran across a new mammoth machine-tool specially designed and built for large Diesel-engine construction at a cost of nearly half-a-million kroners. On this tool almost any part of a Diesel engine up to 4000 h.p. can be machined. Unfortunately the B. & W. Co. were not disposed to allow anything to be said about this remarkable tool or to furnish any illustrations. In a way it is a big sister of the machine just described.

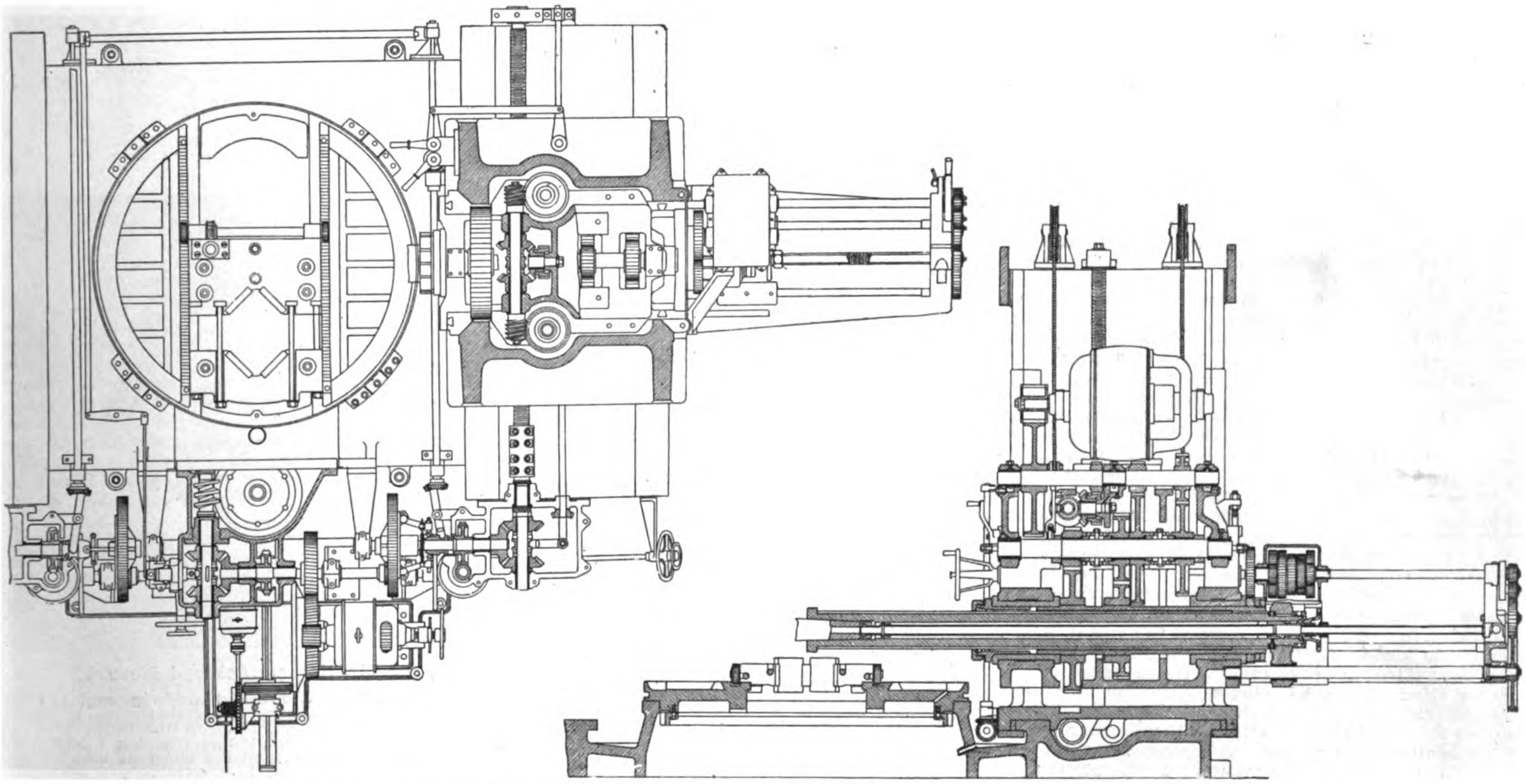


Fig. 3. Drawings of the original B. &. W. crankshaft machine. The American model has been slightly modified.

the power being taken off the prime shaft and transmitted through spur-gearing and an expanding clutch to the bevels, dogs being employed to select the direction of translation. Each housing contains a slide-block, capable of vertical movement between four guides which ensure accuracy and rigidity of fixture. The vertical motion is procured by a pair of feeding screws with nuts on the side block, the weight of the latter being counterbalanced by slabs depending outside the housing, and the power being derived from the motor. Crosspieces at the top stiffen the housing by bracing the guides.

On the slide-block is mounted the driving motor, which through spur-gearing drives a counter-shaft from which an intermediate-shaft can be driven at two speeds, with a further choice of two speeds in the final spur drive to the cutter spindle. It is from the intermediate-shaft that the motion for the vertical feed-screws is taken. On the back end of the cutter spindle there is a crosshead, which forms also a thrust bearing. The crosshead-slides on the guides, and the feed for the spindle is provided by the screw which derives its motion from reduction geaing overhanging the guides this gearing in turn being driven through a gearbox that is arranged for changing the rate of feed. The power is transmitted to the gearbox by means of spur wheels outside the housing.

corresponding web faces, the forging is clamped with the axis of the shaft coincident with the axis of the table.

The cutters are in every instance preferably of a diameter equal to the width of the cut required, and by turning the table and feeding up the cutters the shafts will in three clampings be reduced to the second state. The mode of running up the ends of the journals will be self-evident, the displacement of the axis of rotation of the cutter with respect to the axis of the journals determining the form of the profile. The fourth stage of work is done in a lathe. Then the shaft is clamped in the new machine, being held at the rough-turned piece between the two first cranks and in such a manner that the front and back surfaces of the first crank are parallel with the clamp sides, the clamp being shifted towards the side until the axis of rotation of the table. The crankpin is then formed with the table turning and the cutters feeding forward. The milling of the back and front surfaces of the crank-webs is effected with these surfaces parallel with the direction of motion of the housings, and to form the end surfaces the shaft is held so that the axis of the table bisects the line intersecting the axis of the shaft itself and of the pin.

A study of the drawings will reveal many features that have not been treated, such as the hand feeds, the complete regulation of the ma-

LORD WEIR AND THE OIL ENGINE.

In his address before the Institute of Marine Engineers Lord Weir said that he deliberately classed the coming of the oil-engine as comparable in its importance with the introduction of the steam engine by James Watt. Alluding to the question of oil supplies, he stated that, taking Mexico alone, the wells already drilled, and capped, will produce oil at the rate of 80 million tons per annum, having a calorific value equal to about 120 million tons of coal, or a potential value, if using oil-engines, of approximately 350 to 400 million tons of coal.

"The coal consumption required for the production of motor power in the United Kingdom amounts to 80 million tons per annum. On a very conservative basis, if oil were used for the production of this power in internal-combustion engines, less than 25 million tons of such oil would suffice."

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial Endorsement of opinions expressed.—Editor.)

A COMPLIMENT FROM SENATOR CAPPER

To the Editor of "Motorship,"

Sir:

I have looked over the November issue of "Motorship" with much interest and want to compliment you upon the fine publication you are putting out. I was especially impressed with the information it contained with reference to motor vessels. Without doubt there can be profitable utilization of such power in our merchant marine.

Very truly yours,
Arthur Capper.

U. S. Senate, Washington, D. C.

REGARDS "MOTORSHIP" AS OLD FRIEND.

To the Editor of "Motorship,"

Sir.

I am a constant reader of your magazine, and during the printers' strike and the subsequent absence of the splendid reading and valuable information pertaining to marine matters and motorships—the Diesel engines in particular—I felt something missing; however, the arrival of the November number came as a long lost friend.

Yours very truly,
L. J. Hagen,

324 Salmon St., Portland, Ore.

A CAPTAIN'S EXPERIENCE WITH MOTOR AUXILIARIES AND WOODEN STEAMSHIPS.

To the Editor of "Motorship,"

Sir:

I have just returned from France after a voyage with one of the Shipping Board's wooden vessels. Talk of engine trouble in this steamer,—we had nothing else—but not a word was said about it; whereas, if it had been a motorship everyone would have heard of it.

Previous to this voyage I was master of the motor auxiliary "Adrien Baden" and took her around the world without a hitch, except a few minor breaks in the engine-room, thro' inexperienced engineers. I'll give you a little comparison between a steamer of the Ferris-type, 2400 gross-tons, and of a motorship the same type as the "Adrien Baden," 1600 gross tons. On the steam-driven ship we had to have 750 tons of ballast before she would stand-up at all. We had to pack 680 tons of coal for fuel, and this coal had to be handled by the crew every day getting it to the bunkers when at sea. Thereby the upkeep of the ship on deck was neglected. Had she been a motor ship the machinery would fire itself.

Then we had a crew of 45 on the ship; we could get along better with 22, and when I say "better" I mean by that we would eliminate to a great extent the incompetents among firemen and trimmers. Now the steamer that I was in, altho of greater tonnage and a bigger crew, carried 200,000 thousand feet of lumber less, also could not carry the same long lengths of lumber as the motorship owing to the deckhouses and small hatches. Also we could not carry a deck load higher than 9 feet, whereas the motorship carried 15 feet. Furthermore the motorship was as stiff as a church, whereas the steamer had to be continually trimmed. After carefully figuring on the difference of operation I estimate that there is between $4,000.00 and $4,500.00 to the good in favor of the motorship per month. It beats me to know how companies who build ships, and who are supposed to figure-out the economy of operation, can for a minute hesitate to decide on what to build as the steamer has no chance alongside the properly-equipped and properly-built motorship.

Of course, it is like anything else; if you make a make-shift start it is like everything else; you will have all kinds of trouble. My idea of a motorship is a vessel with the proper amount of power, enough tanks fitted in her bottom to carry oil for 6 months as it will also make her stiff at all times to carry a big deck load if in the lumber trade off shore, also with big hatches and friction winches so as to use the minimum of steam. Cog winches are no good as they crowd the donkey boiler too much and are a nuisance anyway.

There are a great number of skippers against the motorship because of sails, as a lot of them don't want to be bothered, also many who are only steamboat sailors and would be totally ignorant as to the workings of or benefit of sails. Now as far as my observations count, also in the opinions of motor engineers I have been with, they seem to prefer the Werkspoor Diesel engine. Also the friction winch that is put out by Murray, of San Francisco seems to be the ideal winch, as in many years' experience with it I have had the greatest satisfaction with them both as to quick-action and reliability. Also there should be a good big donkey-boiler installed. Electric winches are all right provided there is always an expert at hand to attend to them, but, when you are in some outlandish port and when you happen to have men that have just about enough knowledge to get by I figure a ship is safer with the steam winch.

Also, last but not least, for a good shipbuilder who builds his ship on honor there is no better builder nor better timber than what is furnished by the Peninsula shipbuilding plant at Portland, Oregon. The ship I commanded, the "Adrien Baden," on a voyage to China and Java to France was admired by all who inspected her, and had I had the authority to sell the ship at the time I could have disposed of her at double her cost four different occasions. I know that there is a good demand for the right kind of motorship in the Orient and Australia. But, the motorship got a black-eye out there thru inexperienced handling both on deck and below on account of sending as engineers steam men instead of Gas men, and incompetent men as masters.

I hope my letter will assist in the furtherance of the motorship, as anyone with experience or the least judgment can readily see that it is the vessel of the future. Also it was a grand sight to see the 10,000 tons motor-vessels of the Dutch Oil Co., ploughing their way across the Indian Ocean, and in conversation with some of the masters of those vessels they don't want anything to do with steam as with them coaldust, bum-firemen and a constant growl about keeping steam-up is a thing of the past. The last steamer I was on was specified to go 10 knots, but all she could do was eight, and then more often than not she went seven. What a howl there would have been if it had been a motorship. Incidentally there was hardly a day but that she was not broken down with either a blower or pump and it is the same practically with all of the wooden-ships of the U. S. Emergency Fleet. I went around the world with a motorship and all that happened was a couple of cracked cylinder-heads that could be easily fixed up.

For coastwise service give the motorship the same power as a steamer to fight the bars and there is no question but that she is the best ship, as she can increase the speed at will and there is no necessity of making a special effort by firemen because the valve does the trick. I hope you have all the good luck in the New Year in the interest of motorships, as I realize that to be able to compete against the growing competition that American ships will have to face with Europe as soon as they have their shipping advanced we shall have to use the modern oil-engine ship to have any kind of a show at all.

Yours very truly,
Robert Fergusson (Captain).

1422 Thompson Street
Philadelphia, Pa.

THE HORNSBY-AKROYD OIL ENGINE

Sir, To the Editor of "Motorship".

I have read in the January, 1919, issue of "Motorship" your interesting article on the "Semi-Diesel" Engine. Amongst other items you refer to is the paper read by Mr. James Richardson at the last October meeting of the Diesel Engine Users Association, London, when he again proposed to substitute the word "Semi-Diesel" (for the want of a better one) to denote all types of Oil Engines of the so-called Hot-Bulb class. The word "Semi-Diesel" was first questioned at the meeting of the Institute of Mechanical Engineers, London, April 1915, when it was explained that the word "Semi-Diesel" was incorrectly applied to denote the engine cycle under consideration (described below).

I wonder if it has ever occurred to you and your readers why descriptive names are used by manufacturers to denote the oil-engines bearing their name.

The object in writing this letter, which is perhaps of unusual length, is to explain the true history of the origin of pure air compression with automatic ignition in crude oil engines, and for which may I ask the courtesy if you will grant the space in "Motorship".

The cycle on which ALL the high compression crude oil automatic ignition engines of today work, was actually originated, invented and patented by me throughout the world (including Germany), and I held 33 British, American and other foreign patents (schedule enclosed) years before the name Diesel was ever heard of in connection with crude oil engines in Great Britain or America. In fact I invented and patented in 1890, the two crude oil engine cycles which have made the crude-oil automatic-ignition industry throughout the world.

In order that your readers may understand how automatic ignition in crude-oil engines became possible in practice I will explain some of my work from 1886 to 1893, and show that the whole origin is thoroughly British with American development.

The patents provided that Akroyd Engines could be constructed to work on the four stroke or two stroke cycle. (I did not experiment with gas engines).

When I started experiments on lamp oil or paraffin engines in 1886, there were only two known methods of ignition, one the constant burning lamp type and one electric ignition by battery and coil. In both cases a complete commingling of the oil vapor and air was considered absolutely essential before compression in order to obtain proper combustion. Timed ignition of course prevented pre-ignition.

The goal I set myself was an engine that would work automatically without a lamp. I made all kinds of engines, horizontal and vertical, working on the cycle commingling of air and oil vapor on the induction stroke. See British Patent Office Records 1886 to 1893.

My great trouble with these engines was pre-ignition of the combustible mixture on the compression stroke.

It was not until 1890 that I conceived the idea to change the cycle and **compress pure air only**, keeping out the oil fuel until it was wanted, that I could control automatic ignition under all compression pressures or in other words I controlled ignition by timing the atomized "oil jet" or "oil spray" injection patent No. 7146, 8th May, 1890.

This Akroyd Cycle viz:—timed atomized "oil jet" or "oil spray" injection into compressed pure air is the pioneer crude oil high compression automatic ignition engine cycle of the world.

Twenty-nine years ago I made and sold at Bletchley Iron Works, Bletchley Bucks, England, Akroyd Crude-Oil Engines 2.4.6 B. H. P. Working on this Akroyd Cycle patent No. 7146, May 8th, 1890, using as fuel Scotch shale oil or a Russian oil "Russolene", having a specific gravity 0.854 and flash point 225° Fahr., costing from 2½d to 3d per gallon in Liverpool.

It was some few months after I built this type of engine that I conceived the idea of putting the oil on the suction stroke intto the vaporizer, separated from the cylinder by a narrow neck, and arranging the air valve in the cylinder side of the neck to allow **pure air only** to be **drawn up the cylinder.** This also gave me automatic ignition and another master patent cycle No. 15994, 8th Oct., 1890. The main idea was to give the oil more time to vaporize.

Little experience had been gained by the layman at that early period regarding the working of oil engines, and this Akroyd engine cycle, patent No. 15994, October 8th, 1890, was developed to fill the then requirements of a comparatively low compression simple engine. These engines were very reliable and easily managed.

Mr. Herbert Ackroyd Stewart

At last I had two sound working engine cycles, each having pure air compression with a distinct method of automatic ignition of the working charge. My dream had not only come true but I had plenty of heat and to spare, and the constant burning lamp was to me a thing of the past.

I had now expended some £16,000 in experiments, etc., etc., and held 33 British, American and other foreign patents before Messrs. Richard Hornsby & Sons, of Grantham, England, took up the sole rights to manufacture Akroyd engines under license in June, 1891, for the whole world.

It was after careful consideration that Messrs. Hornsby and myself decided that they should first of all manufacture the simpler of the two Akroyd patent engines, that is the compression of pure air on to oil vapor patent No. 15994, October 8th, 1890. These were marketed as the Hornsby-Akroyd Oil Engines.

But it was left to the American licenses, the De la Vergne Refrigerating Co. of New York, to develop large engines which they made and marketed as the "Hornsby-Diesel". These engines have an **air-blast to inject the oil fuel.**

In 1898 the De la Vergne Co. purchased the Akroyd American patents **outright,** and Hornsbys' reserved to themselves the right of all work-shop drawings and the benefits of all future improvements made by the De la Vergne Coy.

The engines made by me at Bletchley, according to this Akroyd cycle patent No. 7146-1890, **had a timed atomized oil jet injection** and were working constantly every day.

I would like to state that two of the Akroyd engines I supplied to Messrs. Hornsby & Sons in 1891-2, for experimental purposes were made according to the Akroyd cycle patent No. 7146, May 8th, 1890, and two of the Akroyd engines made according to Akroyd cycle patent No. 15994, October 8th, 1890.

Messrs. Hornsby & Sons during the early period of the patents were making slow progress in getting Hornsby-Akroyd engines on the market, so I kept on experimenting at my works at Bletchley, and on February 29th, 1892, I took out the patent No. 3909, for the Akroyd Water Jacketed Vaporizer, and on 29th December, 1892, the patent No. 22664, compressed air starter for Akroyd engines.

"Akroydon," Yours very truly,
Claremont, Herbert Akroyd Stewart.
Western Australia.

Some Notes on the Design and Construction of Diesel Engines

Conclusions Derived from a Study of Assembled Data

BY "DESIGNER"

(Continued from our January issue)

For small engines the cylinders are commonly cast en bloc. This gives a very neat appearing and rigid engine, and is, in the writer's opinion, to be recommended. This method has also been adopted in some large engines.

In designing engines with enclosed crankcases care must be taken to leave the main bearings accessible for adjustment or removal, a point sometimes overlooked. Main bearing shells should be circular, so that they can be removed with the shaft in place; turning the outside of the shell eccentric with the inside facilitates removal of the bottom half of the bearing. The main bearing caps in single-acting engines are not called upon to resist any serious stresses, consequently they can be made fairly light. The dimensions of main bearings will be discussed later under the heading of crankshafts.

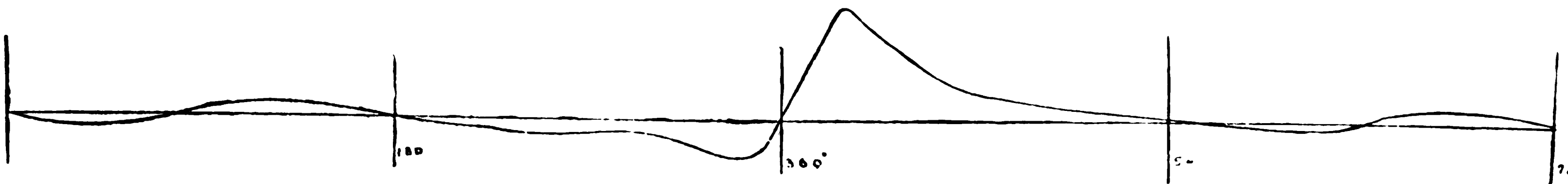


Fig. 5. Tangential effort diagram for four-stroke engine.

Pistons

Since the stresses caused by the high temperature of combustion cannot be calculated accurately, no definite rule exists for determining the thickness of piston crowns. This is decided by each designer in the light of his own practical experience. Piston material should be of the highest quality. Sharp corners should be avoided, as cracks are liable to start at corners. When crossheads and piston rods are used, the piston length should be just sufficient to carry the rings, the number of these being not less than six. Piston friction causes one of the most serious losses in reciprocating engines, and this resistance is naturally a function of the piston length. However, when no crosshead is employed, the piston must be designed to carry the thrust due to the obliquity of the connecting rod, which is considerable in the case of short connecting rods. The longer the connecting rod the greater is the overall height of the engine, and consequently the weight, so that one advantage is outweighed by a disadvantage beyond certain limits. The connecting rod length is usually four and a half to five times the crank radius, although in some cases where the total weight of the engine must be kept as low as possible, as for submarine engines, it is less than this. A diagram of the forces acting on the piston is shown in Fig. 9, the reactions on the liner or crosshead guide being given by the equation

$$S = P \tan \phi = P \frac{\sin \theta}{\sqrt{n^2 - \sin^2 \theta}}$$

where "n" is the ratio between the connecting rod length "L" and the crank radius R. As the forces acting on the piston have already been found in Fig. 4, the pressure or thrust on the liner can be

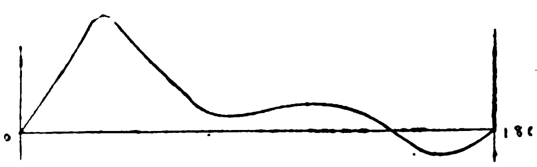


Fig. 6. Resultant tangential effort diagram on crank pin.

calculated for any given values of "n" and crank-angle Θ. Fig. 10 shows a diagram of the thrust on the cylinder for values of n = 4 and n = 5, which shows clearly the advantage of a long connecting rod; the maximum thrust on the cylinder well is practically one-tenth of the maximum pressure on the piston. This thrust is taken either by the crosshead shoe or, in engines with trunk pistons, by the piston itself, and the bearing pressure per square inch of surface should be kept as low as possible (for trunk pistons the projected area, or the diameter x length is always used). Large pistons are usually designed for a bearing pressure of 22 to 25 lb. per sq. in., but in high-speed engines 45 to 50 lb. may be allowed. The effective length of the piston must be taken to the bottom ring only, as the body is tapered off from here to the top to allow for expansion, and consequently cannot be assumed to take any of the thrust load. The amount of taper is usually 0.2 to 0.5 per cent of the diameter, although for small or medium sized pistons up to, say, 12 in. diameter, the maximum clearance at the top should be 20/1000 of an in.; the body of the piston, which should be finished by grinding, should be 4/1000 to 6/1000 less than the cylinder bore. If the clearance is too great the piston will knock badly. On the other hand, the clearance must not be so small that there will be any danger of the piston seizing.

Pistons should be as light as practicable, in order to keep the inertia forces as low as possible, and for this reason an alloy of aluminum has been used successfully in many high-speed submarine engines. No doubt there is great scope for improving the design of pistons in order to reduce the weight and frictional resistance.

Water-cooling systems for pistons have been fully dealt with in these pages recently, and need not be discussed again here.

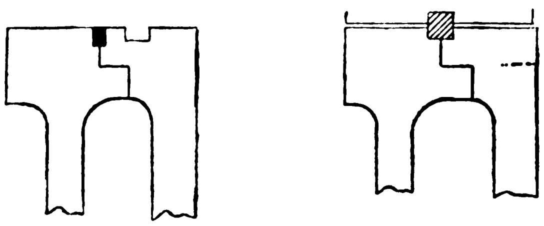


Fig. 7 and 8. Showing joint packing for cylinder liners.

The total weight of the reciprocating parts of Diesel engines, including two-thirds of the connecting rod, is always high, owing to the massive construction of the pistons. For average engines of the trunk piston type it is from 5 to 7 lb. per sq. in. of piston area, although for small high-speed engines it is reduced to 1½ to 2 lb. per sq. in. For engines with crossheads the reciprocating weight is higher, and may reach 10 lbs. per sq. in. of piston area. As this type of engine is usually run at slow speed, the maximum inertia forces are not large.

Gudgeon Pins

Gudgeon pins in trunk pistons should be situated at the centre of the effective bearing length, although they are often placed higher to reduce the height of the engine. If too high the top-end bearing is subject to the heat of the piston crown, especially if the latter is concave, and this is detrimental to efficient lubrication.

Gudgeon pins should have as much bearing surface as possible in order to keep the bearing pressure below 1,800 lbs. to 2,000 lbs. sq. in. The allowable bending stress is 7,000 lbs. to 10,000 lbs. sq. in. A list of different sized units has been prepared in Table IV, which shows the various pressures and stresses allowed by the most reliable firms, and we see from this that the diameter of the gudgeon pin is approximately 0.38 of the cylinder bore, while the length is about 1.3 times its diameter. The gudgeon pin is usually of high tensile steel, finished by grinding, with a hole of large diameter bored through it to reduce the weight. A few firms use a white metal-lined bearing bush, although the majority are of bronze. The pin should be a tight fit in the bush, so that the connecting rod can just be moved by hand when disconnected from the crankshaft. Ample oil grooves should be provided in the bearing leading from the oil hole in the connecting rod up around the side of the bearing. The pressure being downward all the time makes this bearing very difficult to lubricate satisfactorily, and consequently very careful attention is required for its design.

TABLE III—COMPRESSION RATIOS FOR VARIOUS POWERS.

Power Per Cylinder	Diameter	Stroke	Clearance	Comp. Ratio	Volume Ratio
10	7 1-8	8 1-4	9-16	16	6.2%
30	10 1-4	9 7-8	3-8	13.1	6.9%
50	12 3-4	17 5-16	11-16	10.6	9.2%
80	16 1-8	20 7-8	15-16	11.1	8.8%
100	14 1-2	15	9-16	12	8.1%
160	22 1-4	31 1-2	2 3-8	13.73	7.9%
300	30 1-4	39 3-8	3 1-16	13.8	7.2%

TABLE IV—PRESSURES AND STRESSES ON GUDGEON PINS ALLOWED BY VARIOUS WELL-KNOWN MAKERS.

H.P. per Cylinder	Dia. Cyl.	Gudgeon Pin d.	Gudgeon Pin l.	Ratios $\frac{d.}{D}$	Ratios $\frac{l}{d}$	Bearing Pressure.	Bending Stress.
10	7⅛	2 11/16	3½	.38	1.3	2200	9400
30	10¼	4	5 11/16	.385	1.4	1900	9600
50	12¾	5 1/16	6¾	.4	1.275	1850	7500
80	16⅛	6⅛	8 9/16	.38	1.4	2000	9850
100	14½	5¼	7	.36	1.35	2340	10400
110	13¾	5½	7½	.4	1.36	1780	8600
384	24.8	—	—	—	—	1350	—

Gudgeon pin bushings are in most cases split in two halves, after the usual bearing practice, to allow for adjustments, the bearing being secured in the connecting rod by means of a set-screw in the top of the rod. To make any adjustment, it is necessary to take the connecting-rod out, which means dismantling the piston, so that the second method employed, which is to use a solid bush forced into the connecting rod, is really just as good, if not better. When wear takes place the bush must be withdrawn and a spare one fitted, or the old one remetalled. This system is in use on some of the best known makes of engines, and is most reliable, as there is no danger of the set screw working loose. In some large trunk pistons the top-end bearing is bolted to the connecting rod in the same manner as the bottom end, but there is seldom room for this construction.

In crosshead engines the usual marine type of connecting rod is used, and calls for no comment, except that the bearing pressure allowed on the two top-end bearings is low, to provide a safe margin in case the greater part of the load has to be borne on one bearing, due to poor alignment.

Connecting Rods

For Diesel engines, connecting rods are always of forged steel, a round section being usually adopted, although considerable economy can be effected in the weight by using H-sections, since this form is stronger and better able to resist the bending stresses.

The connecting rod is treated as a long column, which has to resist the maximum load, and Euler's

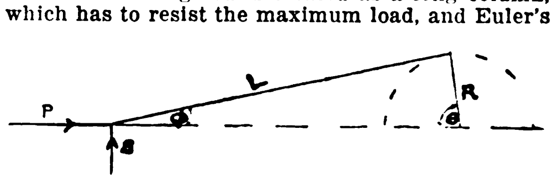


Fig. 9. Diagram of forces on pistons and liners.

general long-column formula is used for this calculation, the factor of safety allowed being from 15 to 20.

Owing to the weight of the reciprocating parts and the high speed employed, the bending moment on the rod due to inertia forces may be considerable. The combined stresses should not exceed 10,000 lbs. per sq. in. In engines fitted with forced lubrication the connecting rod, if round in section, is drilled through the centre to conduct the oil from the crankpin to the gudgeon pin bearing. If an H-section is used, a copper pipe is fastened securely in one of the grooves, thus connecting the upper and lower bearings.

Bottom End Bearings

The bottom end bolts must be strong enough to resist the tensile stress due to the inertia of the reciprocating parts. These bolts have caused serious accidents by breaking. This was probably due to the material of which they were made becoming crystallized owing to the frequent re-

TABLE V.—DIMENSIONS OF CRANKSHAFTS BY DIFFERENT MAKERS.

H.P.per Cylinder	Diameter Cylinder D	Diameter Shaft. d	Main Bearin Length	Crank pin Length	Distant Between Bearings	Ratios d/D	C/L Bearings / D	Main Gear. L/D	Crankpin L/D	Main Bearing Preasure	Crank-pin Pressure
10											
30	1/8	3 9/16	5 1/2	3 5/8	12 7/8	.5	1.82	1.57	1	537	1615
30	107 1/4	5 11/16	9 9/16	5 5/8	20 7/8	.56	2.04	1.6	1	400	1345
50	9	5	5	5	—	.55	—	1	1	660	1320
80	12 3/4	7 9/16	11 3/4	7	26	.57	2.02	1.6	1	384	1290
90	16 1/8	9 1/4	14 3/4	8 3/4	32 3/4	.57	2.02	1.6	.95	384	1295
100	16 1/4	8 7/8	13 11/16	9 1/16	32 1/4	.545	1.97	1.54	1.06	855	2460
110	14 1/2	7 1/2	—	8	24	.515	1.66	1	1	715	1435
150	13 3/4	—	—	—	—	—	—	—	—	355	1140
160	19 11/16	10 5/8	—	—	—	.54	—	—	—	—	—
200	22 1/4	13 9/16	18 9/16	12 1/8	43 1/4	.6	1.97	1.4	.93	790	2400
300	15 3/4	8 3/4	11	8	26 3/4	.55	1.7	1.47	1	527	1450
250	30 1/4	16 1/8	21 11/16	14 11/16	52	.61	1.97	1.34	.91	536	1620
384	24 7/8	15 3/8	20 1/16	13 3/4	48 3/4	.62	1.97	1.34	.92	770	2030
	24.8	14	—	—	—	.565	—	—	—	550	1100

versal of the stresses. This can be safeguarded against by taking the bolts out periodically and annealing them by bringing them slowly to a cherry-red heat in a clean fire, allowing them to remain thus for some hours before cooling, which should also be done slowly. Another cause of failure in bottom-end bolts is due to tightening up the nuts too much, thereby putting too high an initial tension on them. This is probably the cause of more failures than crystallization. Again, it sometimes happens that the bolts elongate slightly when in use. If it is not noticed, very severe shocks are produced owing to the play and the inertia forces. For these reasons bottom-end bolts should be of nickel steel or other high tensile strength material, and the stress allowed should be as small as possible, not more than 7,000 lbs. to 9,000 lbs. sq. in. The nuts should be securely locked to prevent them slacking back, the safest method to employ being a castle nut and split pin.

In order to maintain a film of oil in the bearing during the period of maximum pressure, the bearing pressure should not exceed 1,600 lbs. sq. in., and is usually kept below this figure. The length of the bearing is governed by the average pressure on the sliding surfaces, which is different from the maximum pressure just mentioned. The work lost in friction, according to Guldner, who is probably the foremost authority on Diesel engine design, is calculated from the mean pressure of the complete cycle, that is, for four-cycle engines, the mean pressure for the four strokes, which is approximately equal to 65 lbs. per sq. in. for normal running conditions. If the work lost in friction is denoted by w, and k denotes the unit bearing pressure, then neglecting the co-efficient of friction.

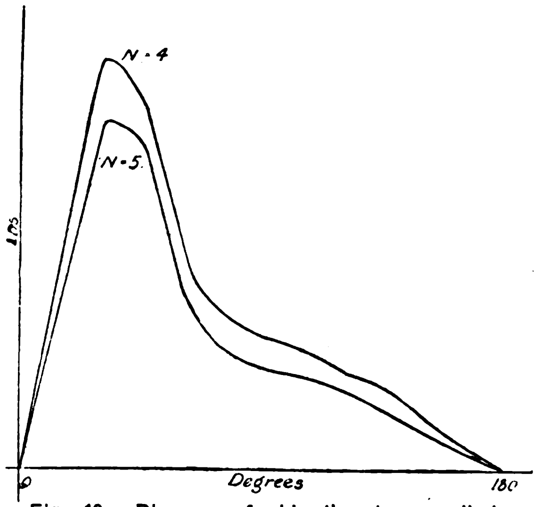


Fig. 10. Diagram of side thrust on cylinder walls with long and short connecting rods.

$$w = kv = \frac{P}{dl} \times \frac{\pi d n}{6 \times 12} \text{ ft lb. per second}$$

but P = pm × Area of piston

$$\text{whence } l = \frac{Pm\ A \times \pi n}{720 \times kv}, \text{ inches.}$$

The factor "k v" should be limited to 1,500 ft. lb. per sec. for white metal bearings and to 1,200 ft. lb. per sec. for gunmetal bearings.

For large engines the bottom-end bearings are usually constructed of cast steel lined with white metal. The quality of the white metal must be good to obtain satisfaction. It might be noted here that a softer grade of metal is used in bottom-ends than in gudgeon pin bearings.

The clearance on bottom-ends when newly set up should not exceed 6/1000 in., and should never be allowed to exceed 12/1000 to 14/1000 in.

Crankshafts

Nickel steel is often employed for small engines, and for large engines only the highest grade material should be used. Under working conditions a maximum fibre stress of 8,000 lbs. sq. in. should be allowed, except in very special cases where a reduction in weight is imperative. Treating the crankpin as a beam loaded in the centre, the bending stress (Sb) is given by the formula

$$Sb = \frac{P \max. \times l}{4} \times \frac{1}{\frac{d^3}{10}}$$

for a solid shaft, where l is the length between the bearings. Whence

$$d = \sqrt[3]{\frac{P \max. l \times 2.5}{8000}}$$

However, for marine engine crankshafts, the diameter must conform to the rules of Lloyd's Register or other classification society, and consequently the formula supplied by them must be adhered to or exceeded.

The main bearing pressures are generally kept to 600 or 700 lbs. sq. in. for ordinary running conditions. A list of crankshaft dimensions is given in Table 5, from which it will be seen that the diameter of the crankshaft averages between 0.57 and 0.6 times the cylinder diameter, while the distance between the main bearings is about twice the cylinder diameter.

Main bearing shells are usually of cast-iron or brass, lined with metal. When newly set up, the maximum clearance should be 6/1000 in. and should not exceed 14/1000 in. at any time, as the bearing oil will escape too easily and the oil pressure will drop. Main bearings with forced lubrication and good white metal give very little trouble, and run for a considerable time before they show any appreciable wear. It is usual to fit shims between the top and bottom parts of the bearing to facilitate adjustment; three or four shims of varying thickness from 1/16 in. to 5/1000 in. are used, so that it is necessary to remove only one from each side to bring the brasses closer together.

Finis

Operation of A Large Diesel-Driven Tanker

Repairs and Voyages During One Year—An Article of Special Interest to Oil Companies

It is not often that motorship owners are willing to give out complete operating details of a vessel but this has been done by the Anglo-Saxon Petroleum Co. in connection with the Diesel-driven tanker "Selene" which they operate on the behalf of the Nederlandsche Indische Tank Stoomboot, Mij. They furnished these details to the "Engineer" of London to whose courtesy we are indebted. The "Selene" has the following dimensions:

Dead-weight Capacity ....5310 tons
Gross Tonnage ....3738 tons
Length ....357 ft. 6 in.
Breadth ....46 ft. 3 in.
Depth ....27 ft. 7 in.
Draught (Foward) ....21 ft. 4 in.
Draught (Aft) ....24 ft. 0 in.
Propelling Power ....2200 I. H. P.

The "Selene" left *Singapore* on October 5, 1918, *for coasting ports*. In these ports no particular work was executed, but, as usual, when a vessel is loading or discharging cargo various work had to be done, such as cleaning filters, cooling pump examined, and air compressor valves to be cleaned, &c.

This ship arrived back in *Singapore* on November 9th, and then made a *voyage to Australia*, experiencing no trouble and arriving on December 29th. Work carried out during ship's stay in port consisted of examining and grinding in air compressor valves and overhauling cooling water pumps.

During the voyage from *Adelaide to Balik Papan* the starboard motor was stopped for 3/4 hour for renewing a joint on exhaust valve-box.

The vessel arrived Balik Papan without any further trouble, and whilst ship was in port the exhaust valves of the starboard motor were taken adrift and ground in, and also some small repairs were carried out.

Voyage Balik Papan to Singapore. When at Singapore the following work was executed: fuel rollers seen and adjusted, some telescopic piping and stop valves seen to, and all bolts on main motors tried.

Voyage Singapore to Bordeaux. For this voyage attached please find log abstracts. Work done in latter port consisted of cleaning fuel-filters, interchanging air-compressor valves, inspecting lubrication, I.P., H.P., and air-compressor pistons opened up, rings renewed, and grooves trued up.

All crosshead, crank bearings, and main shaft-bearings fitted, and fuel-valve needles repacked.

Voyage Bordeaux to Abadan. The ship left the latter port on April 17th, when the port motor was stopped for 1 3/4 hours for air compressor; and on April 19th the starboard motor was stopped for 2 hours for interchanging an exhaust valve.

The vessel *arrived Port Said* on April 29th and reported "all well," and then proceeded to Abadan, where she arrived May 18th without having experienced any trouble.

On *arrival at Abadon* the suction and delivery valves, air-compressors, main and auxiliary motors were opened up and cleaned.

Fuel and lubricating oil-filters were also cleaned and two exhaust valves changed.

The "Selene" then *left for Colombo* and then round to the coast ports, eventually arriving at Singapore for her periodical docking on June 26th. During this overhaul the following incidents were noticed:—

All bearings and crank-pins opened up for inspection of the crank-shafts, and after careful inspection were found to be in good condition.

The starboard shaft was worn down 0·7 mm. over all bearings, and the usual wearing towards the middle bearings was not noticeable in this case.

The port shaft was worn down 1.0 mm. in the No. 1 bearing, 0.8 mm. in the middle bearing, and 0.6 mm. in the No. 8 bearing. All journals were bearing very nicely and no sign of salt-water being mixed with the lubricating-oil was noticeable.

All bearings and crank-pin brasses were adjusted.

Two pistons were taken out for examination and found in good condition; as the other pistons were not leaking they were left untouched.

Further to this, the usual repairs were done when vessel was in dry dock. The ship left dock on July 13th for two coast voyages and turned back to Singapore on July 19th without experiencing any trouble.

Work executed during stay in port was:—Repacked some fuel-valve needles, renewed two piston bolts, and secured cooling water pump straps, &c.

Vessel left port for Suez on July 23rd.

On July 25th both motors were stopped for 3/4 hour for examination of crank-shaft, and on August 1st both motors were stopped successively for 1/2 hour to examine bottom-ends, and also on August 10th the starboard-motor was again stopped for 3 hours for broken slipper guide bolt..

Without any further difficulties vessel *arrived at Suez on August 18th.* During ship's stay in port for discharge of cargo the following work was done:—L.P. and I.P. air-compressor rings renewed, valves and air-compressors cleaned and ground-in, fuel-filters and mud-boxes cleaned, &c.

Vessel passed through the Suez Canal *and left Port Said for Hull on August 27th.*

The port motor was stopped on September 2nd for 1/2 hour for fastening up piston-bolts on No. 5 cylinder, and also on September 12th for 2 hours for renewing two broken-off piston bolts.

Vessel arrived without further accidents at Hull on September 12th, when practically no repairs were found necessary.

Having given this information "The Engineer" makes the following comments:—

"It would be possible to gather quite a disconcerting impression from this report by laying stress upon the fact that in a series of trips covering some 50,700 nautical miles eight stoppages are recorded, and it is necessary to analyze

(Continued on Page 120)

Interesting News and Notes from Everywhere

THE FUNCTION OF THE TECHNICAL PRESS

(*Continued from Page* 116)

On the other hand publicity expenditures sometimes are in the hands of advertising specialists, with whom publicity is purely a cold business proposition, and whose main task is not to consider such elements as those discussed, but to always bear in mind the direct sales-returns from the actual advertising announcements paid with their client's money, which incidentally they naturally desire to produce to demonstrate their own value to the advertiser. It is not for them to advocate a form of subsidy to trade magazines. They have their own sphere of work.

We give these matters the light of print for the purpose of indicating the real need of adequate support to technical publications without which the latter could not exist unless the charges to the reader were almost prohibitive. Because of these sound reasons, we maintain that all *good* technical publications deserve, and should have, the wholehearted support of the entire particular section of each industry concerned. True it is that when an industry becomes strong many papers try to represent that field, and all cannot be subsidized. But, it is a simple matter to eliminate those journals that do not merit recognition and support, by a study of their editorial columns and general business policies and by the use of discrimination founded upon the results of the investigation.

STANDARD OIL CO. ORDERS ANOTHER DIESEL-DRIVEN TANKER

We announce that the Standard Oil Company of Cal. has ordered a 4,600 tons d.w.c. motortanker from the Moore Shipbuilding Company of Oakland, Cal., which vessel will have a capacity of 45,000 barrels, or approximately 1,800,000 gallons. In this vessel two six-cylinder 1000 s.h.p. (1400 i.h.p.) Skandia-Werkspoor Diesel-engines of the four-cycle type will be installed. All auxiliary machinery will be Diesel-electric driven and will be constructed by the Skandia Co. and by the Allan Cunningham Co., Inc., of Seattle, Wash. The length of this vessel is 330 ft.

This makes the second Skandia-engined motortanker recently ordered by the Standard Oil interests on the Pacific Coast, while two big Vickers motor tankers are building in England. It is most gratifying to note the splendid support being given to the industry by this great oil company.

CONVERSION OF THE STEAMER "TRYGVE" TO DIESEL POWER

Occasionally we hear of the conversion of a motorship to steam power, such as the old Krupp-engined experimental tanker "Glenpool" and the early tanker "Emanuel Nobel," but the total number of such cases can be counted on the fingers of one hand. In fact, in the case of the "Emanuel Nobel" she had not been in service six months with the steam machinery, when the owners desired to replace the oil-fired reciprocating engines and boilers with the original Diesel engines, but the American company who carried out the conversion work would not sell the motors to the original owners for less than *three times their original cost.*

However, the conversion of steamships and sailing vessels to motor power is practically a weekly occurrence. Another case in point is the old 600-tons steamer "Trygve,' built on the Clyde in 1872, which has been fitted with a 250 shaft h.p. Polar-Diesel oil-engine. She is now owned by the Stockholm Transport Co., of Stockholm, Sweden, and has the following dimensions:

Length	185' 0"
Breadth	25' 5"
Depth	11' 4"
Engine speed	200 r.p.m.
Original fuel consumption	7 tons per day
Present fuel consumption	1 ton per day
Present daily saving in fuel bill	$200.00

The Diesel engine is a four-cylinder, reversible, two-cycle type, 12½"x18½" model built in Stockholm. She now carries over hundred tons more cargo than she previously could, adding to her earning powers.

SUBSCRIBERS AND ADVERTISERS ABROAD, IMPORTANT NOTICE

Owing to the very adverse rates of money exchange, we suggest that all subscribers and advertisers in foreign countries make payments to us by means of International Money Orders obtainable from any Post Office. So far as we have been enabled to ascertain post offices in the leading countries still allow normal exchange rates up to sums of $500.00 maximum per week. Application at its nearest post office will enable accurate information to be obtained on this subject.

DIESEL ENGINE CONSTRUCTION AT HARLAND & WOLFF'S

We understand that Lord Pirrie recently advised Sir Marcus Samuel that the Diesel-engine plant of Harland & Wolff at Glasgow is turning out one set of marine type Diesel engines of high-power every six weeks.

SUBSCRIBERS' ADDRESSES WANTED.

Will Mr. R. L. Whitham, 4021 Arcade Bldg., Seattle, Wash. please send us his present address, as copies of "Motorship" sent to the above address are being returned by the Post Office. Will Mr. C. L. Straube also please send his present address.

NOT FOR HANNEVIG INTERESTS.

On page 37 of our December 1919 issue, we refered to an auxiliary motorship building at the yard of the Slidell Dry Dock and Shipbuilding Co. Through a printer's error, the heading of another paragraph became attached to the paragraph in question resulting in the paragraph inferring that the vessel is for Hannevig interests. The vessel in question is not for Messrs. Hannevig.

NEW JAPANESE OIL ENGINE

Another Japanese marine heavy oil engine of the surface-ignition type has been placed on the market, namely that built by Tohru Miyasaki (Tokyo Gas & Electric Engineering Co., Ltd.), Otemachi, Kojimachiku, Tokyo, Japan.

MORE BUNKER-OIL DEPOTS.

Arrangements for establishing depots for the sale of oil-fuel for bunkering in all parts of the world are being made by the Anglo-Persian Oil Company, said Sir Charles Greenway, Chairman, at a recent meeting. In Persia he said, his company has already proven and brought into production several fields, each of which, they have reason for believing, is capable of producing as much oil as in Baku, and that there are many other fields in their territories which give equal promise. When their program for bunkering ships is completed the company will be in a position to supply fuel-oil in extensive quantities to ships at practically all of the principal ports in the United Kingdom and other countries.

THE CONCRETE MOTORSHIP "ASKELAD"

Some months ago we published details and photographs of the Bolinder engined concrete motorship "Askelad", a vessel of about 1,000 tons d.w.c. This vessel has been in service between Christiania, London, Shields, Rotterdam, Gothenburg, etc. We have extracts of her log before us from Dec. 11, 1918, to Sept. 4, 1919, during which time she made 16 voyages. During this period the starboard-engine was stopped four times for replacing air-valve springs and the port-engine was stopped twice for air in the suction-line, twice for replacing air-valve springs, and once for cleaning-out the fuel-injection nozzle, but the engine was started again every time without reheating the hot-bulb. The total running time was 1,238 hours. The cost for repair parts during the eight months was $2.70; namely, six air-valve springs at 45 cents each. The fuel-consumption of the twin-160 h.p. engines together averaged 137.5 pounds an hour.

DEATH OF PACIFIC COAST SHIPBUILDER

We very much regret to announce the sad death of Mr. David Hollywood, General-Manager of the South Western Shipbuilding Co., East San Pedro, California, and formerly of Oakland, California, who was killed on January 17th when his automobile collided with a street car. Mr. Hollywood was in the prime of life, being 41 years of age, and was one of the founders of the South Western Shipyard, which company is also associated with Schaw Batcher Shipyards of San Francisco.

AN INQUIRY FROM INDIA

(Delayed)

We suggest that American oil-engine builders get into communication with Mr. A. Besse, Superintendent-Engineer, Vypeen, Cochin, Malebar Coast, India. He has charge of the building of a teak hull full powered motor vessel of 1,500 tons displacement, to be powered with two 160 b.h.p. Beardmore surface-ignition engines. These engines are of a successful British design and will give vessel a speed of 9 knots. The auxiliaries such as steering gear, windlass, winches, etc., are electric motor driven and supplied by Messrs. Perman, of England.

He writes: "I happened to read in 'Motorship' an article regarding electric drive for Diesel engined vessels, which embodies my own ideas of economy and elasticity, coupled with safety and efficiency.

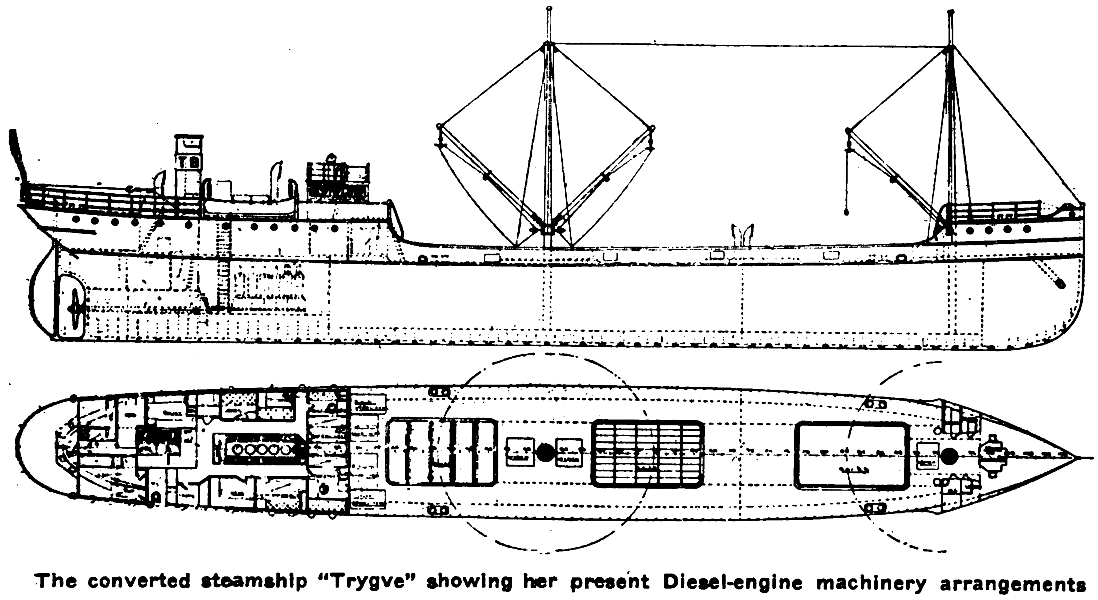
"We propose to have vessels in the future of about 2,500 to 3,000 tons cargo carrying capacity with a minimum speed of 12 knots, and it is just possible that the vessels in question are intended for our American trade from the Red Sea.

"Having in view the development of marine Diesel engines and possible future competition, we would like to be at once in a position to defy any competition. Therefore it is imperative that the strictest economy should be our policy.

"I am of the opinion that there should be multiple sets of generators so as to have small cylinders in the Diesel engines.

"Should you be able in your letter to quote me possible cost of plant to drive vessels of the tonnage I mention, about 12 knots, I should be much obliged to you, and your answer might decide my principal to place his future orders in the U. S. A.

"The real object of adopting electric drive, however, is economy when at work and reduction of labor."



The converted steamship "Trygve" showing her present Diesel-engine machinery arrangements

TANKER FOR EAST ASIATIC

It is said that a 4,500 ton Diesel-driven tanker is building at the Nakskov Shipyard for the East Asiatic Company. The vessel is for the transportation of oil-fuel for the company's motorship fleet.

DIESEL MOTORSHIP "CIMBRIA"

A Diesel engine has been installed in the new motorship "Cimbria" built for the Aktiebolaget Svenska Maritimverken by the I. C. Petersens Mekaniska Verstadts Varv of Trellaborg, Norway.

"ASTRI I" RENAMED "FJELDTING"

The Pacific Coast built wooden auxiliary "Astri I" 1723 tons gross has been renamed "Fjeldting". Her owner is Mr. Johsleborg of the Skibs. Akties Leborgs Rederi, of Christiania, Norway. Two Bolinder oil-engines form the auxiliary propelling power.

ANOTHER FRENCH CONCRETE MOTORSHIP

An order for a concrete motorship 241 ft. by 23 ft. has been placed with the Chantiers Navales deVilleneuve, Loubet, France, by Messrs. R. Va. Helmeryck, of Paris.

FRENCH MOTORSHIP "COMAFRAM II"

In our article on the motorship development in France published in our December issue, we omitted to refer to a new motorship named "Comafram II" launched at Pont de Neuilly for the Compagine Franco-Anglaise. She is of concrete construction and displaces 1000 tons, and two Diesel engines are being installed.

NEWFOUNDLAND AUXILIARY WITH AMERICAN ENGINES

Messrs. J. Williams & Co., of St. Johns, Nfld. have taken delivery of the wooden auxiliary sailing-ship "Jacoio," 498 tons gross. This vessel was built by the Newfoundland Shipbuilding Co., at Harbour Grace, Nfld., and is fitted with a two-cylinder American built Skandia surface-ignition type heavy-oil engine.

NEW NELSECO DIESEL-DRIVEN TUG AND FREIGHTER

Aside from big seagoing motorships, undoubtedly the most interesting commercial motor-vessel built on the Pacific Coast this year is the "Ambassador" which was recently launched from the ways of the Tacoma Shipbuilding Co. and is now in Alaska, doing service for the owners, the Chichagoff Mining Co. The new boat is a combination freighter and tug for carrying supplies between Juneau and the company's mines at Chichagoff, Alaska, also for towing a 600 tons barge carrying supplies from Puget Sound to the mines.

The "Ambassador" is 112 ft. in length with a beam of 22 ft. and a draft of 10 ft. 7 inches. She is built to stand the heaviest weather that can be encountered along the coast and her hull is sheathed with iron bark at the waterline to protect her from the ice. Her power plant is a 360 h. p. direct-reversible Nelseco Diesel engine built by the New London Ship & Engine Co. of Groton, Conn. It has a bore of 13 inches and a stroke of 18 inches and is a six cylinder model developing its power at 240 r. p. m. It is of the company's latest four-cycle design with force-feed lubrication. Her fuel cost is only about $1.12½ an hour or $11.25 a day, which, when her size and power are taken into consideration, will be recognized at once as a very inexpensive operating cost.

In addition to the main engine, the "Ambassador" is also fitted with a 16 h. p. Atlas auxiliary engine that belt-drives a 12 kilowatt generator, furnishing power for the Moran centrifugal bilge-pump, the air-compressor, and current for the electrically-driven machinery which includes a cargo-winch and anchor windlass, the latter being specially designed and built for this boat by the Markey Machinery Co.

The boat was designed by Messrs. Lee & Brinton. She is electrically lighted by 56 M. V. No. 7 Exide storage battery cells. She has a deadweight cargo-capacity of 100 tons and makes a speed of 11½ knots.

UNIQUE NEW YEAR'S GREETING

From one of our readers in Japan we have received a very novel New Year's card. It is from the Maruzen Company, Ltd, (Maruzen Kabush iki Kaisha) of Tokyo, Japan, and is a handpainted view of the famous sacred mountain with the sun shining on it, the rays being painted in gold. The greetings are in the English language.

THE IMPORTANCE OF OIL

During 1919 a record breaking number of new business enterprises were filed in the various states of America. Companies with a capital of $100,000.00 or over their aggregate capital involved over $12,677,229,000. Of these 1629 new oil companies have a capital of $3,786,000.00, representing over one-fourth of the total amount.

MOTORSHIP SERVICE BETWEEN SAN FRANCISCO AND EUROPE

The Johnson Line of Stockholm has started a permanent motorship service between San Francisco and Europe. Owing to the low operating and bunker costs of these Diesel-driven craft and because of their extra cargo capacity, it is not possible for American steamships to compete for freight against these. American shipowners please note.

THE "LAKE MOHONK" and "LAKE ONEIDE" CHANGE NAMES

The motorships "Lake Mohank" and "Lake Oneida" are now owned and operated by the Astoria Mahogany Company, 347 Madison Avenue, N. Y. C. The names of these vessels have been changed to "Astmacho III" and "Astmacho IV," respectively.

AMERICAN OFFICES OF FRANCO-TOSI CLOSED

The New York offices of Franco Tosi & Co., of Legnano, the well-known Italian marine Diesel-engine builders, were closed on Dec. 31st, 1919, Communications should be addressed to the Head-office in Legnano. Licenses to build their marine type Diesel-engines have been secured by the Manitowoc Shipbuilding Co., of Manitowoc, Wis., and by the United Engineering Works of San Francisco, Cal., while their stationary Diesel-engine is built by the Fulton Iron Works of St. Louis, Mo.

BINDERS FOR 1919 "MOTORSHIP"

We have some excellent binders neat and strong, for the 1919 copies of "Motorship." The price is only $2.00, or one can be obtained free with a three years' subscription. Do you need one?

VERHEY'S LECTURE AT PHILADELPHIA

The Diesel-engine lecture by Mr. H. Verhey before the Society of Automotive Engineers at Philadelphia was a great success and was followed by an interesting discussion. We hope to publish both in our March issue.

JAPANESE LOOKING FOR OIL ENGINES TO BUILD UNDER LICENSE

Mr. Tatsuzo Kosugi, a retired admiral of the Imperial Japanese Navy, has recently returned to Japan after having made an exhaustive study of the Diesel engine in this country. Mr. Kosugi contemplates manufacturing an American type of Diesel engine in Japan and is probably the foremost advocate of Diesel-powered vessels in the far east.

A SPLENDID SHIPBUILDING OUTPUT

During 1919 the Bethlehem Shipbuilding Corp. launched 146 vessels of which 132 were delivered. The total engine power of these ships is 1,850,000 I. H. P. Most of these ships were naval craft, but included 22 oil tankers, 12 cargo vessels and 20 tugs.

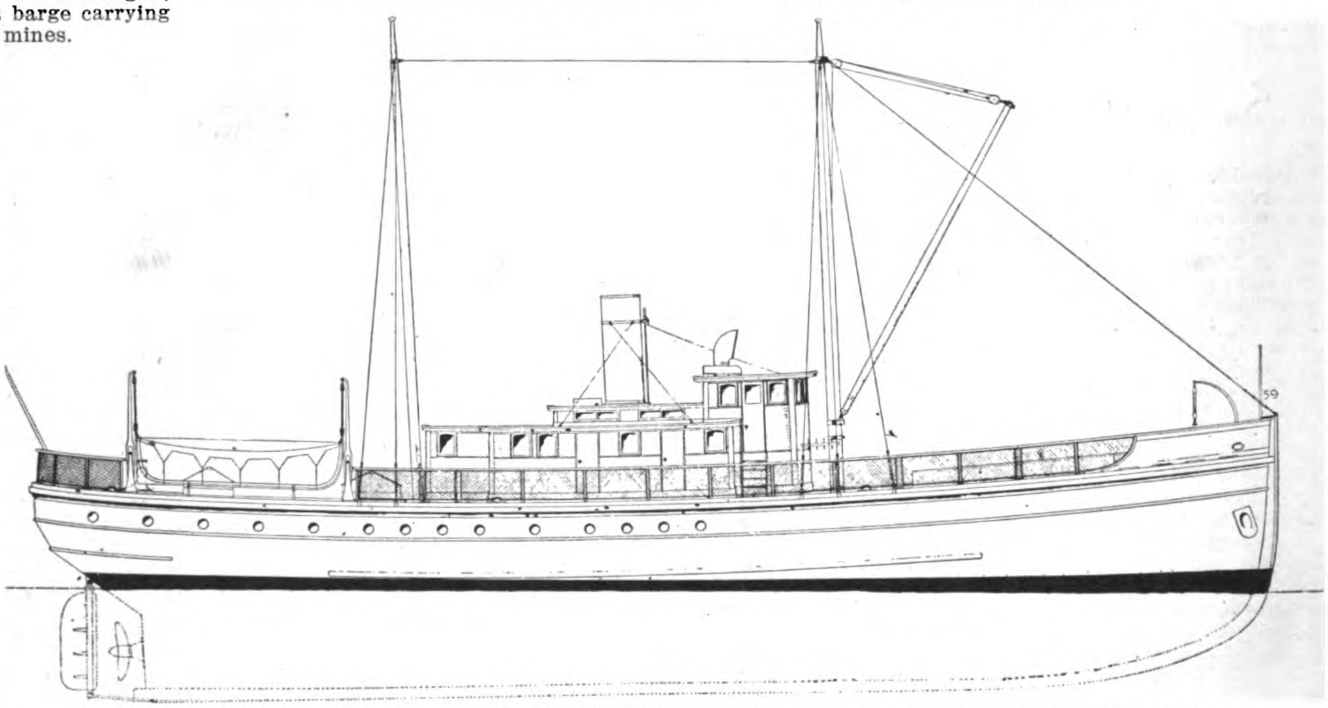
MANY ORDERS ON HAND FOR DOMESTIC SHIPOWNERS

We understand that the Bethlehem Shipbuilding Corporation has orders on hand from private American shipowners for 31 vessels of 382,000 lbs. D. W. C., the contract prices of which total about $18,000,000.00. This is in addition to the U. S. Navy and Emergency Fleet Corporation vessels of a value of about $152,000,000.00.

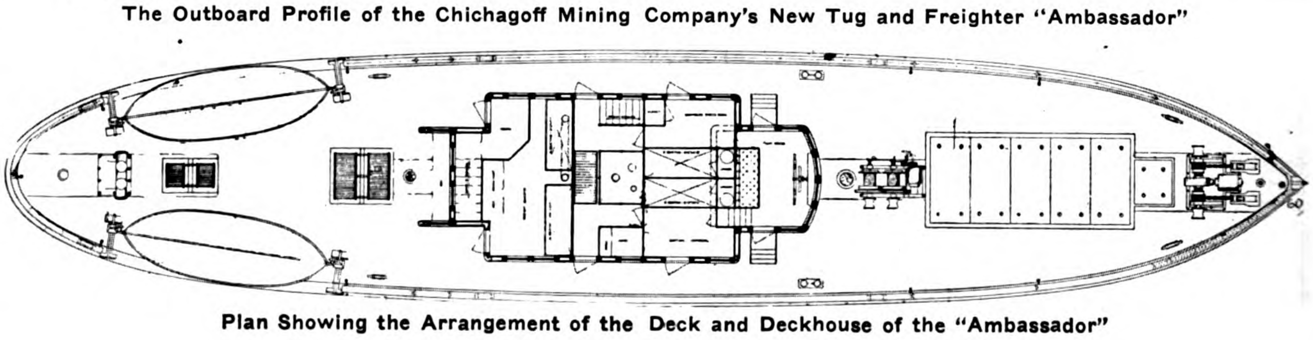
Now under construction at their Fore River plant is a Diesel-driven motor ore carrier of about 12,000 lbs. D. W. C. It is to be hoped that this vessel will be a forerunner of a large fleet of motorships to be constructed by the Bethlehem Steel Co. As a review of the work done, it forms a good indication of what this will mean to the United States.

A NEW OIL ENGINE MAGAZINE

With the view of advocating the further use of "oil power" and for the purpose of imparting all current information concerning oil as a source of power in general, a little publication entitled "Oil Power" is being issued monthly by Messrs. Plenty & Son, Ltd., of Newbury, England. In addition to original articles, this publication will gather under one cover, extracts from the world's press on this subject. The price is 3 d, but we understand that a copy will be sent free of all charge and obligations each month, to executive officials of companies who are interested sufficiently to write to the firm in question.



The Outboard Profile of the Chichagoff Mining Company's New Tug and Freighter "Ambassador"



Plan Showing the Arrangement of the Deck and Deckhouse of the "Ambassador"

Norwegian Shipowners Place Orders For Three More Large Motorships With Dutch Shipbuilders

A Suggestion That American Shipbuilders Send Representatives to Scandinavia With View to Securing Orders on Basis of Quick Delivery

IN our issue of November we gave a list of eleven steel Diesel motorships aggregating 50, 050 tons d.w.c. and 25,270 I.H.P. that have been placed with Dutch builders by Norwegian shipowners through negotiations by the firm of Otto Kahrs of Christiania.

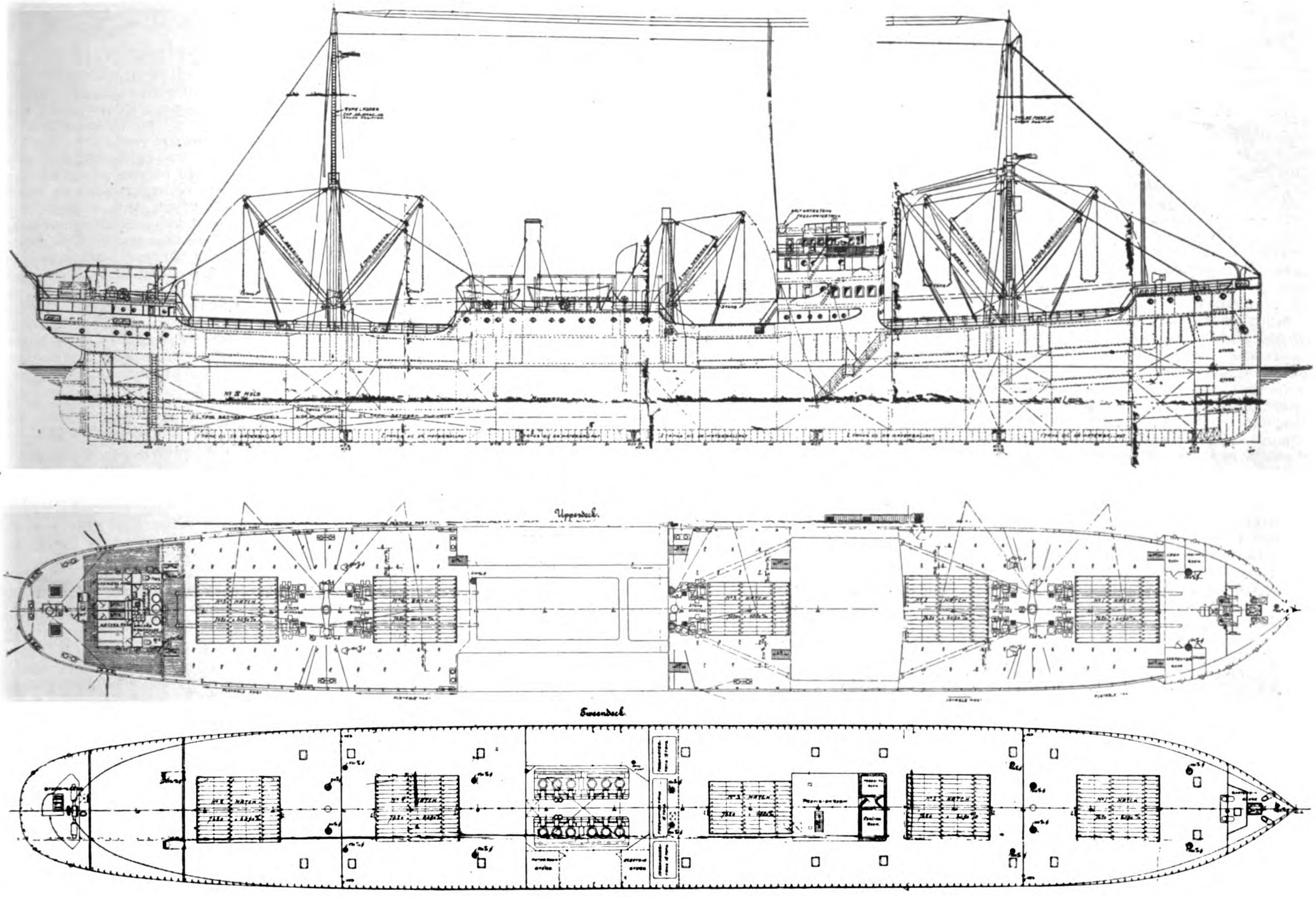
Since then orders have been placed by Norwegians with shipbuilders in Holland for three more steel motorships aggregating 21,500 tons d.w.c. and 10,080 I.H.P. thro' the same agency. One of these vessels is for the P. Kleppe Rederi of Bergen and she is a twin-screw 6500 tons d.w.c. vessel of 2900 I.H.P., who we understand are connected with P. Kleppe & Ostervold & Co., Inc., of 27 William Street, New York, N. Y.

The second vessel is for the Dampsk Storfonds Akties (Sigval Bergensen, Manager) of Stavanger, Norway, and this is an 8500 tons d.w.c. vessel of 4280 I.H.P. The third ship also is for the same management, being a 6500 tons d.w.c. Diesel-driven ship of 6500 tons and 2900 I.H.P. in twin-screws. In all these motorships Werkspoor-Diesel engines are to be installed. The following list is a revision of the names and dimensions of the motorships on order in Holland including the above recent addition.

We republish this list in its complete form in order to stimulate American shipowners, and in order that they may realize the active manner in which Scandinavian shipping interests are entering the motorship game. Only similar or better American motorships can compete against these economical European vessels. America then will have the advantage of her oil supply in her favor. We suggest that our cargo motorships where possible be built to maintain speeds of 14, 15 and 16 Knots, which can be done without increasing the fuel-consumption beyond that used by a 11-Knot oil-fired steamer of the same overall dimensions, and without reducing the normal cargo capacity. *(Continued on following page)*

Name of Ship	D. W. Capacity	Owner	Power	Make of Diesel Engines	Builder of Hull
Salerno	6500 tons	Otto Thorensen, Christiania.	2600–2900 IHP	Werkspoor.	J. & K. Smit, Kinderdyk, Rotterdam
San Miguel	3050 tons	Otto Thorensen, Christiania.	1300–1450 IHP	Werkspoor.	J. & K. Smit, Kinderdyk, Rotterdam
Sardinia	3000 tons	Otto Thorensen. Christiania.	1940–2140 IHP	Werkspoor.	J. & K. Smit, Kinderdyk, Rotterdam
San Andreas	3000 tons	Otto Thorensen, Christiania.	1940–2140 IHP	Werkspoor.	J. & K. Smit, Kinderdyk, Rotterdam
San Paulo	6500 tons	Otto Thorensen, Christiania.	1940–2140 IHP	Werkspoor.	Rijkee Shipbuilding Co., Rotterdam
Unnamed	2200 tons	Otto Thorensen, Christiania	1300–1450 IHP	Werkspoor,	Wood & Skinner, Newcastle-on-Tyne
Unnamed	2200 tons	Otto Thorensen, Christiania.	1300–1450 IHP	Werkspoor.	Wood & Skinner, Newcastle-on-Tyne
Athene	6600 tons	Salversen & Co. Kragero	2600–2900 IHP	Werkspoor.	Rijkee Shipbuilding Co., Rotterdam
Geisha	7000 tons	Winge & Co. Christiania	2600–2900 IHP	Werkspoor.	Netherlands Shipbuilding Co., Amsterdam
Tosca	7000 tons	Winge & Co. Christiania	2600–2900 IHP	Werkspoor.	Netherlands Shipbuilding Co., Amsterdam
Aida	7000 tons	Winge & Co. Christiania	2600–2900 IHP	Werkspoor.	Netherlands Shipbuilding Co., Amsterdam
Unnamed	6500 tons	P. Kleppe-Rederi of Bergen	2600–2900 IHP	Werkspoor.	Rijkee Shipbuilding Co., Rotterdam
Unnamed	6500 tons	Dampsk Expedit Akties, of Stavanger	2600–2900 IHP	Werkspoor.	Rijkee Shipbuilding Co., Rotterdam
Unnamed	8500 tons	Dampsk Storfonds Akties, Stavanger	3880–4280 IHP	Werkspoor	J. & K. Smit, Kinderdyk, Rotterdam

Total 14 Ships. 75,550 tons. 6 owners. 31,800–35,350 IHP. 1 Engine Maker. 4 Builders.



Plans of the 7000 tons d.w.c. motorships "Geisha," "Tosca" and "Aida" now building in Holland for Winge & Co., of Christiania.

In view of the large numbers of orders for motorships now being placed by Norwegians, we suggest that American shipbuilders who are prepared to give reasonable delivery for Diesel motorships should send their representatives to Norway, or else communicate with the Otto Kahrs Kommanditaktieselskab, Raadhusgaten 1 & 3, Christiania, Norway, which firm we have just mentioned was responsible for all the above orders being placed. But we will warn shipbuilders that we believe any attempts to offer steam-driven vessels to this firm will have a very frigid reception.

We know that shipbuilders in Holland are overloaded with orders and that delivery is very slow, whereas some American firms can offer 6 to 12 months delivery, and this should out-weigh the higher cost of American vessels, as the owner will have opportunity of making profits before the freight-rates drop.

Regarding the three new motorships "Geisha," "Tosca" and "Aida" we are enabled to reproduce plans in this issue. They are owned by Winge and Co., Christiania, Norway, and have the following dimensions:

The Hull

Length B. P. ....371 ft.
Moulded Breadth ....40 ft.
Moulded Depth to Main Deck..............23 ft.
Mean Draught ....23 ft. 1 in.
Light Draught—Amidship ....10 ft. 6 in.
Dead-weight Capacity ....6430 tons
Cargo Capacity (About)................6150 tons
Fuel Capacity (Fuel-bunkers in Tunnels) .218 tons
Ballast-Water Tankage ....1088 tons
Oil-Tankage (in Ballast-Water Tanks when required) ....929 tons
Diam. of Each Propeller.3600 m/m (11 ft. 9¾ in.)
Pitch of Each Propeller....3100 m/m (10 ft. 2 in.)
Projected Area of Each Propeller...........3.6 m.
Dia. of Tailshaft ....310 m/m (12.204 in.)
Length of Engine-room space 13.9 Meters (46½ ft.)
Ballast-Water (Fore and Afterpeaks)....115 tons

The Machinery.

Propelling Engines—Four-cycle Type, Twin-Screw
Cylinders per Engine.........................6
Cylinder Bore ....22.047 in.
Cylinder Stroke ....39.370 in.
Ind. H. P...................1400 max. 1270 normal
Mean. Ind. Pressure............100 lbs. per sq. in.
Engine Speed ....125 R. P. M.

The wing tank fuel-supply is 218 tons which is nearly sufficient for a round transatlantic voyage, so if 929 tons of fuel also is carried in the ballast-water space of 1088 tons as arranged, it means that at least 800 tons of bunker-oil can be discharged as cargo in Norway where fuel-oil is about 46 dollars per ton today.

(Continued in Column Below)

British Shipbuilders Commence Motorship Campaign

Wake Up, American Shipbuilders!

WHILE several American shipbuilders have offered motorships to shipowners in their published publicity announcements, not a single firm has yet come out with a strong campaign on the behalf of the Diesel-driven motorship. That is to say, advertise both steamships and motorships and at the same time boldly point out the great advantages of the oil engined system of propulsion over that of steam.

This, however, is now being done by the well-known British shipbuilding firm of Doxford & Sons, Sunderland, England, who in their advertisements in the shipping papers place their standard single-deck cargo-vessel before shipowners. Of these crafts 45 are built or building for British or foreign owners by Doxford.

This standardized model has the following dimensions:

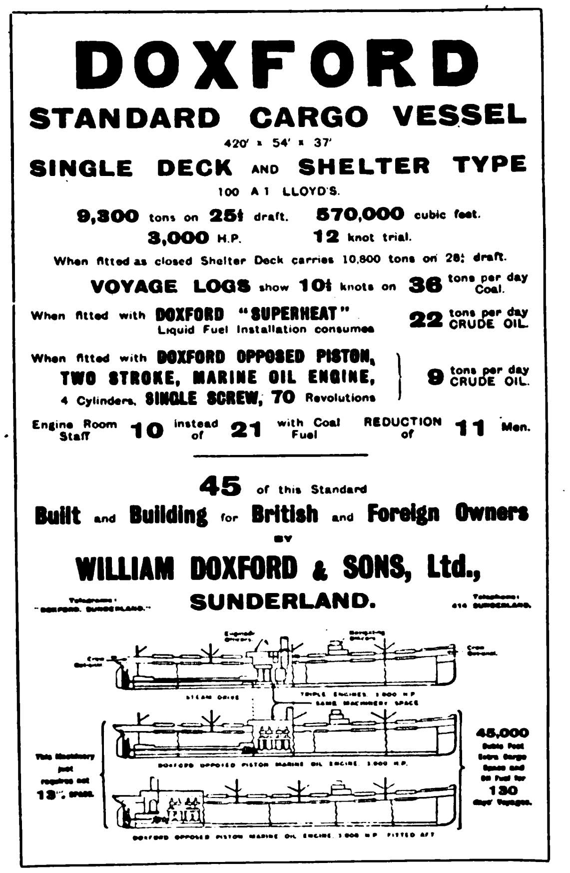
Dead-weight Capacity (25½ ft. dft.) .....9300 tons
Cubic Capacity ....570,000 cu. ft.
Length ....420 ft.
Breadth ....54 ft.
Depth ....37 ft.
Draught ....25½ ft.
Power ....3000 s. h. p.
Trial Speed of Ship.....................12 knots
Log Speed ....10½ knots
Engine Speed ....70 R. P. M.

Messrs. Doxford, who are experienced steamship builders, point out that if their oil-engines are installed the cargo-capacity will be increased by 45,000 cubic-feet and oil-fuel for 130 days voyages can be carried, rendering the ship independent of home fuelling stations.

Also that compared with the same hull fitted with their "Superheat" liquid-fuel steam installation of saving of 13 tons of fuel per day is affected; the oil-motors only using 9 tons. The same ship of coal-burning will use 36 tons, and will require a machinery staff of 21 men instead of 11 men, with the motorship.

With most heavy-oil engines there is a saving of machinery space, but no attempt has been made to reduce the length or weight of the Doxford engines, because of the foolish British ruling whereby the engine-room must occupy a certain amount of space in order to reduce the gross tonnage, so they occupy the same space as their steam engines and boilers but save water and bunker space. If the hull is built of the closed shelter-deck type she will carry 10,800 tons on 28¼ ft. draught.

While we are glad to see such enterprise and foresight, we cannot but regret that it does not come from some well-known American Shipbuilding company. Some information concerning the Doxford engine and what the company is doing appeared on page 51 of our November 1919 issue. Wm. Beardmore & Co. also are to soon start a similar campaign. See page 53 of the same issue.



A miniature reproduction of the advertisement of Doxford & Co., the British shipbuilders, which we publish to stimulate the action of American shipbuilders

YET ANOTHER GLEN LINE MOTORSHIP.

Launch of the 6,800 Gross Tons Diesel-driven Vessel "Glentara".

Towards the end of December last another of the Glen Line's motorship fleet was launched, namely the "Glentara," at Harland & Wolff's Govan yard. She has the following dimensions:

Gross tonnage ....6800 tons
Length ....420 ft.
Breadth ....54 ft.

Her Diesel engines were constructed at the builders Lance Field Quay (Glasgow) plant and all the auxiliaries will be electrically driven.

DOUBLE ACTING DIESEL ENGINES.

(Contributed)

At the present time, the general interest in the marine line is largely concentrated in the development of the four-cycle engines simply for the reason that very few two-cycle marine Diesel engines have so far shown a very favorable success on merchant ships over any reasonable length of time. At the same time, the two-cycle engine is making its headway and two or three leading companies are said to have made great progress in this line. This development recalls the 6,000 H. P. double-acting two cycle marine engine, which was started by the Nurnburg Works of the Augsburg-Nuremberg Maschinenfabrik long time before the war. This is a three cylinder engine with a cylinder of 800 mm (32 in.) bore x 1060 mm (42in.) stroke and running at 160 R. P. M. The engine was designed with the view in mind to complete this engine later to a six-cylinder engine of 12.000 H. P. and to be used on a three screw German battle-ship. We learned recently that this engine fulfilled its requirements shortly before the end of the war, but there has been no chance of trying the engine on board a ship, also at one time it was badly damaged by fire.

One thing, however, is of interest in the development work, that the difficulties which are always advanced as the objection to double-acting engines, that is, the lower cylinder head and the stuffing-box, have been solved to satisfaction. The writer himself has been for years a co worker on a smaller double-acting two-cycle engine with a cylinder of 480 mm (19 in.) bore and 710 mm (28 in.) stroke. After years of experimenting work on the first engine of this type, this engine was built as a second engine, and was a distinct success. It was fully demonstrated on this engine, that when the lower cylinder head is properly designed the difficulties pointed out above can and have been overcome.

The advent of the double-acting Diesel marine engine can be only a question of time. Should not an American be a pioneer in this line, by building an engine upon the experience which has years ago been obtained at high expense of time and money?

NORWEGIANS ORDER THREE MORE MOTORSHIPS

Continued from Top of this Page

This means, of course, that their total cargo-capacity is about 8,000 tons each (excluding fuel and water), which is most remarkable for vessels of their dimensions. Also it means that the ships will receive more for their surplus fuel than was paid for the total amount taken aboard in America. In other words they will have no fuel-bill whatever—and, some American shipowners still order steamships!

German Merchant Vessel with Double-Acting Diesel Engines

British Shipowners Secure the Motorship "Fritz"

A WELL-KNOWN firm of British motorship owners has managed to acquire the novel German motorship "Fritz," which forms one of the vessels handed over by Germany under the terms of peace or Armistice. This ship is of the greatest importance to the marine-engineering world, as she is the only vessel in the world fitted with double-acting type Diesel engines. It is to be hoped that the Shipping Board made strong endeavors to secure this vessel for the United States. Whether any attempt was made with this object in view we have no knowledge at the present time.

Before the war a set of 850 h. p. double-acting marine Diesel engines of the two-cycle type were built by Blohm & Voss the well-known Hamburg Shipbuilders who at that time were working in conjunction with the Nürnburg works of the Machinenfabrik Augsburg-Nürnburg. Prior to the out-break of the war they completed a twin-screw set each motor being of 850 shaft h. p. Both these engines ran extensive trials in the makers' works and were installed in a ship and had war not been declared they would have run trials about Sept., 1914. At the present time we do not know whether they are two new engines built as the result of the experiments with the first set, or whether they are the same pair which had three double-acting cylinder 480 mm bore (18-897 in.) by 650 mm (25-590 in.) stroke and developed their power at 120-130 R. P. M.

Tanks for Marine Oil-Engine Installations

Arrangements for Small Motor Vessels

By S. HOWARD SWEET

MAIN AND AUXILIARY FUEL-TANKS

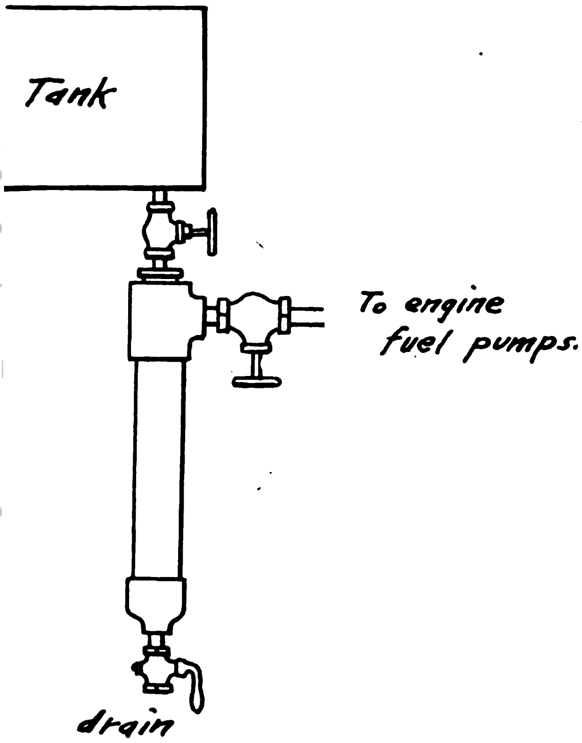
FUEL is usually carried in double bottoms or in tanks.

The tanks should be well made so they will not leak, and well supported in position.

Cubical tanks because of their form require to be heavily constructed, well braced and supported with bulkheads to withstand the strain and prevent leakage. This means care in design and installation. For these reasons cylindrical tanks are usually preferred, because their form makes them strong, they can be built lighter and generally stow well.

Cylindrical tanks can be supported by saddles, embracing about one-half the circumference and strapped to same, so that they will not shift.

The gravity or day tanks are placed well up in the engine room, as the fuel flows to engine by gravity. The fuel is pumped to these tanks from the main supply tanks by means of a gear, plunger or other form of pump or by air pressure. The day tanks should have capacity enough for a whole day's supply or at least for several hours. The larger the capacity the better, as the fuel will have a better chance to settle. Any sediment or water will collect at the bottom from where it may be drained off. It is well to have the fuel supply pipe, where pipe connects to the tank, a little above the bottom of the tank. A wise precaution is to have a settling arrangement placed at the tank.



It is essential that fuel supplied to engine be clean. Small particles of dirt or foreign matter will stick in the valves of pump or spray nozzles and cause no end of trouble. Filtering of the fuel is very essential. Filter or strainer should be placed at the day tank, one at suction side of fuel pump, and, if possible, still another at the spray nozzle. A strainer between main supply tanks and day tanks is advisable, thus protecting each point where trouble may occur. Dirt may come from pipes or joints, between tanks and spray nozzles. It is good installation to have two strainers at day tanks so that one may be cut out and cleaned while operating with the other.

The piping connection to tank should be extra strong. If the first pipe fitting is a nipple it can be made of bar stock with a smaller hole through it than in a standard fitting. When copper tubing is used a circle or coil can be used up close to day tank to take up strains due to vibrations.

A good tank is a cylindrical steel tank galvanized or tinned, with riveted and welded joints. Tinned tanks are best. Welding should be properly done so as not to remove life of metal. Painting of tanks gives longer life. It is said that cork painting will prevent sweating. Cork painting is done by giving tanks a sizing coat, and before it is dry sprinkle with powdered cork. Then a light coat of paint followed by a heavy coat.

When fuel is carried in double bottoms or in special shaped tanks built to suit the hull it is more difficult to compute the capacity.

It is necessary to find the cubical contents of these tanks or compartments and convert same into gallons, pounds or tons.

Find the capacity in cubic feet and multiply by 7.48 to get gallons; by 54.6 to get pounds; or by 0.0273 to get tons. The capacity of each tank may be computed and the sum of all tanks will be the total capacity.

[These figures seemed to be based on the following assumptions: sp. gr. of oil = .8736, and one ton equals 2000 lbs. Editor.]

In computing the contents of these irregular shaped tanks the method usually used is to divide same into regular shaped figures, as near as possible. If side of tank is curved, the curved line may be replaced by a straight line as shown in Fig. 5. Fig. 2 shows a tank of irregular shape which could be divided into regular shaped pieces as shown in Fig. 3. Piece shown in Fig. 3—c is rectangular and the rest are triangular. The triangular shaped pieces b and d combined form a rectangular piece, and pieces a and e do also. This simplifies the problem.

If the tank is the same section, as it is on the end, for the whole length, all that is necessary is to find the area of the end and multiply by the length to obtain the volume of the tank. The volume can then be changed to gallons, pounds or tons as desired.

Table below gives the various conversion figures:

Capacity of Small Cylindrical Tanks

1 gallon = 231 cu. in. = 0.134 cu. ft. = 7.3 pounds = .00365 tons.
1 cu. in. = 0.0043 gal. = 0.316 pounds = 0 0000108 tons.
1 cu. ft. = 1728 cu. in. = 7.48 gal. = 54.6 pounds = 0.027 tons.
1 pound = 0.1048 gal. = 0.018 cu. ft. = 31.1 cu. in.
1 ton = 274 gal. = 36.63 cu. ft. = 63291 cu. in.

Most of the double bottom compartments are fairly regular in shape and are easily figured. They may be first figured without regard to frame plates and braces, etc., and the volume of same deducted or an allowance made for same. The lightening holes and holes connecting compartments being taken into consideration. Single compartments between frames or compartments extending over several frames may be considered.

Capacities of cylindrical tanks in gallons per foot of length:

Capacities of Tanks in Gallons Per Foot in Length (Theoretical)

Diameter in inches	Circumference in inches	Capacity in Gallons per foot in length
12	37.7	5.87
14	43.98	8.0
16	50.26	10.44
18	56.55	13.2
20	62.83	16.3
22	69.12	19.74
24	75.4	23.5
26	81.68	27.57
28	87.97	32.
30	94.25	36.7
32	100.53	41.76
36	113.1	52.86
40	125.66	65.26
44	138.23	79.
48	150.8	94.
52	163.36	110.3
56	175.93	127.9
60	188.5	146.83
66	207.35	177.67
72	226.2	211.45
78	245.04	248.16
84	263.89	287.83
90	282.74	330.39
96	301.5	376.
102	318.38	424.36
108	339.25	475.76
114	358.1	530.1
120	377.	587.35

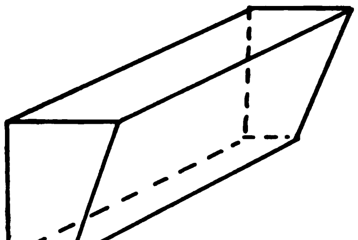


Fig. 1.

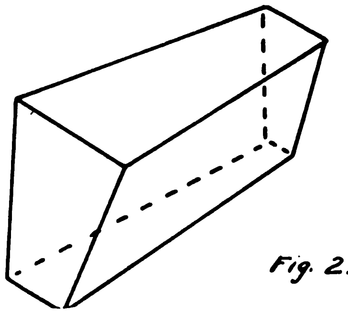


Fig. 2.

The capacity of a tank in gallons may be found by finding cubical contents in cubic inches and dividing same by 231. There are 231 cubic inches in a U. S. gallon.

Capacity of Cylindrical Tanks

Capacity in Gallons	Size Diam. Length in Inches
24	14 x 36
26	16 x 30
32	16 x 36
32	18 x 30
40	18 x 40
45	18 x 42
50	18 x 48
50	20 x 40
65	20 x 48
80	20 x 60
80	22 x 50
100	22 x 60
100	24 x 54
120	24 x 60
140	24 x 72
150	30 x 48
180	30 x 60
260	36 x 60
300	30 x 96
300	36 x 72
425	36 x 96
425	42 x 72

AIR TANKS

Air tanks for starting and for whistle are

Air tanks for starting and for the whistle are cylindrical in form because of the pressure required for whistles is generally not over 100 pounds, the ordinary galvanized range boiler is probably good enough. For starting air, when higher pressures are used, heavier material is required.

These tanks should be installed, when possible, as near to the compressor and the whistle as possible, so as to minimize the amount of piping and possibility of leakage.

Double relief or safety valves should be used as a precaution in case one should not operate.

A pressure gauge is placed at tank or other convenient place as desired, and it should be tested occasionally.

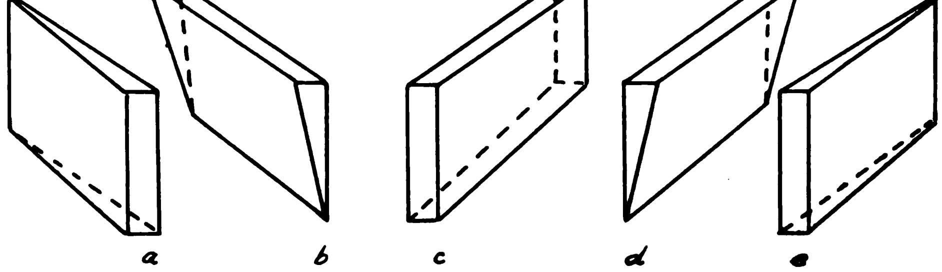


Fig. 3.

The capacity or size of air tanks for starting or whistle depends upon the capacity of compressor. It may be small if the pressure can be quickly replaced. Lloyds calls for starting tanks to have a capacity sufficient for at least twelve starts.

The starting air tanks may be used for whistle, but if pressure above 125 pounds is used for starting, it is advisable to place a pressure reducing valve in the line to whistle.

As it is essential that starting air be conserved, so that all the air will not be used without the engine being started functioning; there should be several tanks or bottles so piped that one may be used at a time and then cut out and another cut in. The proper time for doing this may be ascertained by watching the gauge.

FRESH WATER TANKS

Water tanks are often made in cubical form of galvanized iron, but the same arguments hold for water as apply to fuel regarding cubical and cylindrical tanks.

A tank which is tinned inside is best for water, as it keeps the water purer.

KEROSENE TANKS

Kerosene tanks are placed conveniently so that kerosene may be drawn when desired.

A drip pan should be placed so as to catch all leakage. This applies to other tanks where there is a liability of leakage.

LUBRICATING-OIL TANKS

Lubricating system depends on the engine. Individual grease or oil cups, force feed, splash feed, or combination systems are used on main bearings. Mechanical oilers are very generally used for cylinder lubrication.

A tank is usually provided for overflow from crankcase, or for oil which is periodically cleaned out and renewed. It can then be drawn from tank and filtered or clarified. There are several filtering and clarifying systems on the market.

Fresh lubricating oil will be carried in tanks or barrels. Small tanks with cocks should be securely fastened in engine room and plainly marked. Loose oil tins or cans should not be left around where they are liable to be knocked over. A tray should be provided for them.

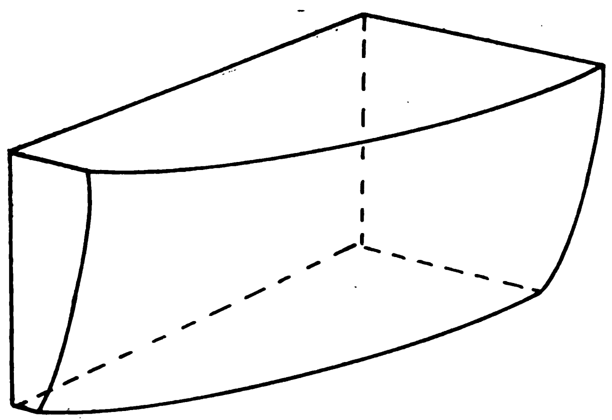


Fig. 4.

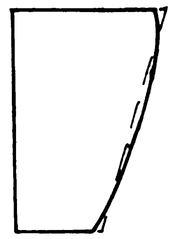


Fig. 5.

A can should be provided and marked for clean and for oily waste.

On page 20 of "Motorship" for January, 1918, there is shown a system of lubrication applied to a Sumner engine. Oil is drawn from a main supply tank to a small tank, from which it is forced by air pressure not over 35 pounds, to the force feed cylinder lubricator. Oil from crankpits runs to sump, from where it is pumped to filter. From filter it runs to force feed bearing lubricator.

On page 22 of "Motorship" for April, 1918, there is described another oiling system, where oil is pumped through filters to coolers, then to pumps on main engines which deliver oil under pressure of about 10 pounds to the lubricating system.

The August, 1918, issue of "Motorship" has a very good article on lubrication of marine heavy oil engines.

FILLING SYSTEMS AND TELLTALES

In installing fuel filling systems, the piping and fittings should be so arranged that spilling of oil is prevented and so that spilled fuel will not run below decks.

A vent should be provided on tanks to allow air to escape when filling and to enter when being drained.

There are different methods of ascertaining the amount of fuel in tanks. The marked stick is sometimes used which is inserted through the filling hole. There are different kinds of gauges manufactured, with dials and hands for indicating amount of fuel. These devices are not necessary except for the day tanks. These are usually refilled daily and a gauge or gauge glass, which can be marked off in gallons, can be provided so that an accurate reading can be kept of the amount of fuel consumed.

Graphical Solutions of Mathematical Equations

Designers of internal-combustion engines have to solve various equations which are much involved. Inspections of such equations after substituting values for the variables often fail to reveal the approximate solution. In that case the complete solution must be carried through before the effect of any change in the variables can be definitely known.

Recently while investigating a certain planetary gear train it was found that the equation for the speed reduction had to be solved completely each time any change was made in the gear sizes. The graphical solution of the equation may be of interest to designers of oil-engines for the following reason. The basic form of the equation was that of an hyperbola or C=XY. And fomulae relating to the pressures and volumes of expanding gases are of the same type. The law connecting the pressure and volume of a gas is $PV_n C$. Thus it is seen that except for the presence of the exponent n, the two equations are identical. This exponent can, however be taken care of graphically. (See any text book on graphic statics).

A description of the arrangement of the reduction gear might be interesting, but is unnecessary for this discussion. Without going into the derivation of the formula for the reduction it was found to be

$$(1) \qquad \frac{n2}{n} = \frac{(r3-r2)\ (r2-r1)}{(r1-r3)}$$

where n_2 = r.p.m. slow speed shaft
n=r.p.m. of high speed shaft
and r_1, r_2, r_3 = radii of the gear wheels.

At first glance this does not look very much like the equation of an hyperbola, but it may be rewritten and the result is

$$(2) \qquad \frac{n2}{n} = \left(1-\frac{r2}{r3}\right)\left(1-\frac{r2}{r1}\right)$$

Now for a given ratio of reduction $\frac{n2}{n}$ becomes a constant say C. Let the first term of the right hand part of the equation equal X and the second term equal Y.

$$X = \left(1-\frac{r2}{r3}\right)$$

$$Y = \left(1-\frac{r2}{r1}\right)$$

Substituting in (2) we get C=XY.

If we plot a number of hyperbolas of varying constants C, we will establish an area on the chart embracing various values of the co-ordinates X and Y. The problem before us is to find graphically values of $\left(1-\frac{r2}{r3}\right)$ and $\left(1-\frac{r2}{r1}\right)$ and use them as abscissae and ordinates of the curves.

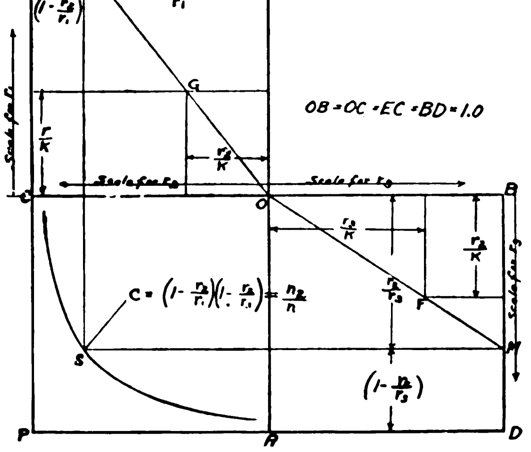
This may be done as follows:

The origin of the whole chart is at point O. The sides of the squares are all of equal length which we will call unity. On OB is to be scaled all values of the radius r_3. Similarly values of r_2 will be plotted along OC and BD. Values of r are to be scaled along CE. These values must all be made less than unity by dividing by a constant large enough to keep them within the chart. This is indicated by plotting $\frac{r3}{k}$ to the right of O along OB; $\frac{r2}{k}$ to the left along OC and along BD; and $\frac{r1}{k}$ along CE.

In the lower right hand square the co-ordinate $\frac{r2}{k}$ and $\frac{r3}{k}$ locate the point F. Connect O and F and prolong the line to M. Then by similar triangles

$$(3) \qquad \frac{BM}{BD} = \frac{r2}{r3}$$

$$\text{but BO=1, } \therefore \frac{B}{M} = \frac{r2}{r3}$$



Graphical construction of formula involving compound terms

Proceeding further,

BD=BM=DM and

substituting for BM and BD we obtain the graphical representation of

$$(4) \qquad DM = \left(1-\frac{r2}{r3}\right)$$

By the same construction and reasoning in the upper left hand square we obtain the length HN equal to $\frac{r2}{r}$ and

$$(5) \qquad EN = \left(1-\frac{r}{r}\right)$$

But EN and DM are seen to be co-ordinates of the hyperbola passing through point S and therefore the constant of that curve will be the value of the fraction $\frac{n2}{n}$ or the reduction obtained by the particular selection of gear sizes. For clearness no other curves are shown.

The above may be made suitable for equations of gases by the addition of the graphical construction necessary to raise one of the co-ordinates to a given power. It is not the intention of this short description to proceed with that problem. However, it is evident that even complex formulae may be solved graphically after the preliminary analysis and construction have been completed. The use of charts of this nature is extensive and every designer can make his own according to the problem at hand. It requires some ingenuity at times to re-group the factors of a mathematical expression so that a simple graphical construction is possible. RDK.

ARMSTRONG-WHITWORTH DIESEL ENGINES.

During 1919 four marine Diesel engines of 1200 shaft horsepower each were completed by Sir W. G. Armstrong-Whitworth & Co., Ltd. Submarines to the total of 5,560 horsepower also were completed by them, including one submersible of 1164 tons gross.

A CURIOUS MYSTERY.

When the motor trawler "Eendracht YM 170" sank in one of the docks at Rotterdam, neither her owner nor skipper was to be traced. Some time afterwards, the owner put in an appearance and the vessel was raised by a local salvage company. It was found that everything of value, even the oil engine had disappeared.

"Motorship" Illustrated Patent Record*

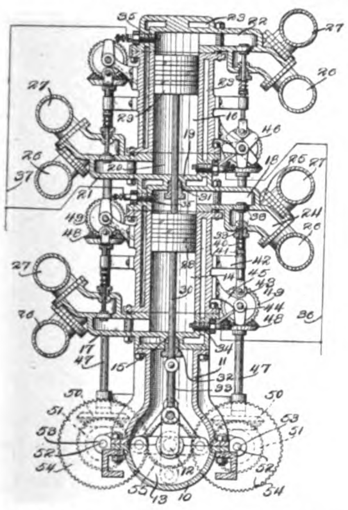
Selected Abstracts of Recent Published Patents of Internal-Combustion Engines

Copies of original specifications may be obtained for ten cents each, by addressing the "Commissioner of Patents, Washington, D. C."

***Compiled and described by H. Schreck, Consulting Diesel Engineer**

1,310,368. July 15, 1919. Arrangement of Engine. E. W. Overstreet, of Murray, Utah.

This invention refers to a tandem arrangement of cylinders for internal combustion engine. At the same

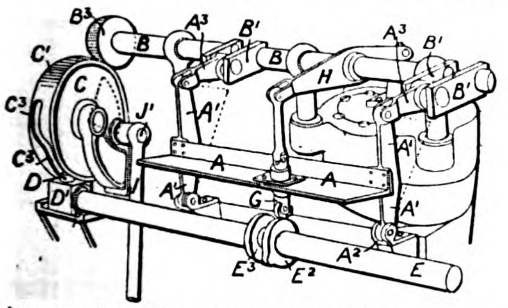


time this engine is of the double-acting type, since combustion chambers are provided at both ends of each cylinder.

All the other features employed on this engine are self-explanatory from the illustration, and, as it will be noticed, there is hardly any difference in the valve arrangement, valve gear, spark plugs, etc., from the well-known arrangement on gasoline engines.

125,044. Dec. 23, 1918. Reversing Valve Gear. North British Diesel Engine Wks. and J. C. MacC. MacLagan, both of Glasgow, Scotland (British Patent).

This invention relates to a reversing valve gear for Diesel-engines, or rather to a novel design of bringing into engagement or to retract the rollers of the valve rods for reversing the engine. In this particular case separate cams are provided for ahead and astern running and the camshaft is moved endwise. A guiding

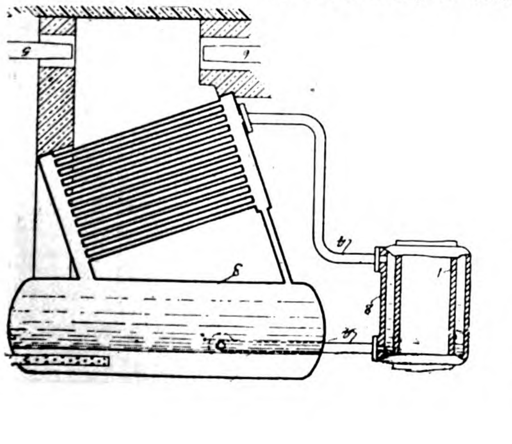


device consists of a frame A mounted upon links A^1, which are pivoted at fixed points A^2 and operated by the links A^3 and the cranks B^1. These cranks are a part of the shaft B carrying at its end the pinion B^2, which meshes with a segment C^1 on the drum C. In order to reverse the engine the drum is turned by means of the rod I which will turn the pinion B^2, operate the shaft B and thus the cranks B^1 will withdraw the rollers from their cams. The push rod I continuing to turn, drum C will shift the camshaft (E) as the pin D will follow the curved part of the groove C^3 on the periphery of the drum.

1,306,979. June 17, 1919. Internal Combustion Engine. W. J. Still, of London, England.

This patent refers to the Still-Acland combination Diesel and steam engine. The first patent on this engine was covered by the British patent 25,356 of 1910, in which engine steam is used expansively at the back of the piston. This engine was described and illustrated at length in our journal on page 25 of the July issue of this year.

In the accompanying drawing which is merely a diagram the principle of the American patent is shown. It designates 1 the cylinder, 3 the boiler, 5 and 6 burners either for oil or for exhaust gases, and the main steam pipe. The waterjacket of a Diesel engine is connected with a steam boiler which will raise the temperature of the water to the temperature of the water in the boiler. The water will preheat the cylinder and a much lower compression pressure can be used than is necessary for starting a cool

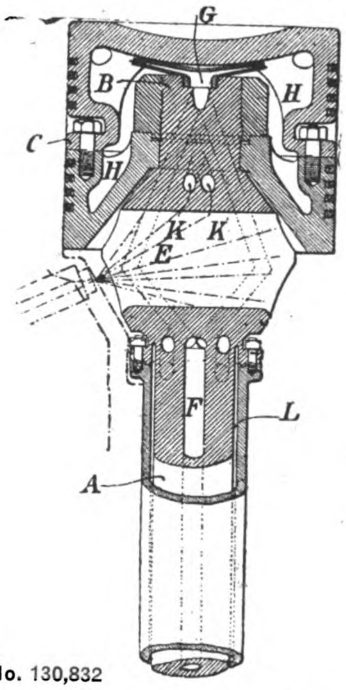


engine. After the engine is running and gaining temperature by the combustion of the charge, the water reverses its function and operates, by evaporation, as a cooling agent, thus maintaining the cylinders at a safe temperature, and the steam produced can be utilized either at the back of the pistons or in connection with any other independent steam plant.

130,832. Sept. 23, 1918. Piston. North British Diesel Engine Works and J. C. Maclagan, both of Glasgow (British Patent).

This invention relates to pistons and piston rods for internal combustion engines of double-acting Diesel type, and has for its object to provide a piston having its underside formed to the contour of the combustion space, and to provide an internal supplementary combustion space into which the fuel is directed by which arrangement the piston rod will form no obstruction to the flame or burnt away by the latter.

The piston proper is built up of two pieces. The lower part is secured to the piston rod by means of the piston rod nut and the upper part is secured to



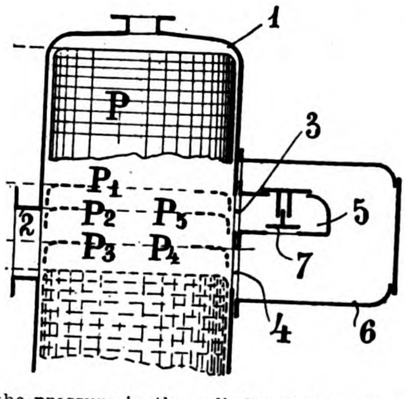
No. 130,832

the lower portion by studs and nuts. To permit of the circulation of the cooling water the piston rod has a central bore F, which debouches at its upper end into passages formed in the wall of the enlargement and passes around the combustion aperture E to the upper end B of the piston. A branch piece G takes care of the distribution of the water. Passages connect the space H with the upper ends of a second series of passages K, the lower ends of which communicate with an annular space L between the piston rod A and a sleeve M embracing it. The cooling water flows up by the annular space L and returns through the bore F.

1,321,392. Nov. 11, 1919. Scavenging of Two-Cycle Engines. C. Reale, of Genoa, Italy.

This patent resembles very much the patent 1,075,603 of Mr. von Schmidt, of Germany, and which is being built by the Busch-Sulzer Bros. Diesel Engine Co. of St. Louis. However, this new invention suggests one point which is novel on this arrangement, which is, that the scavenging valve is automatically controlled by the difference of pressures and not mechanically, such as, on the application referred to above.

When the piston on its downward or expansion stroke reaches position P1 the valve 7 will remain closed since the pressure in the cylinder is considerably greater than that in the scavenging air manifold 6. Only after the piston has cleared the exhaust port



2 and the pressure in the cylinder decreased and until an excess of air pressure exists the valve 7 will be opened automatically. By this time port 4 will also be cleared, and air is being fed through all ports. On the upward stroke of the piston the latter will first cover the exhaust ports, while the fresh air continues to pour in through valve 7 until the pressure built up in the cylinder is equal to the pressure of the air manifold. By this time the valve will close by its own weight.

1,312,605. August 12, 1919. Engine Arrangement. L. Wygodsky, of Baltimore, Assignor to the Baltimore Oil Engine Company.

This patent refers to an engine with two crankshafts and to means for transferring power from one crank shaft to the other.

The Inventor applies his patent to a two-cycle engine with opposed pistons, as it is illustrated in Fig. 1. The manifold 6 indicates the scavenging air inlet and manifold 8 indicates the exhaust outlet. Each one of each pair of the co-acting pistons is transmitting its power to the upper or lower crank shaft respectively. The transmission of the power of one crank shaft to the other is clearly indicated in Fig. 3.

The crank pins 23 and 24 are pivoted in crank pin bearing blocks 25 which are sliding in square guides of the vertically-sliding I-shaped casting 26. This construction makes it possible, and in this case desirable, that the two crank shafts can turn over in opposite directions; it is required in this case in order that the same crank pins of the main engine may serve for connecting rods of laterally opposite cylinders, and in order that the main engine may be reversible.

The I-shaped casting carries also the piston rods of the scavenging air pumps 32.

Fig. 1.

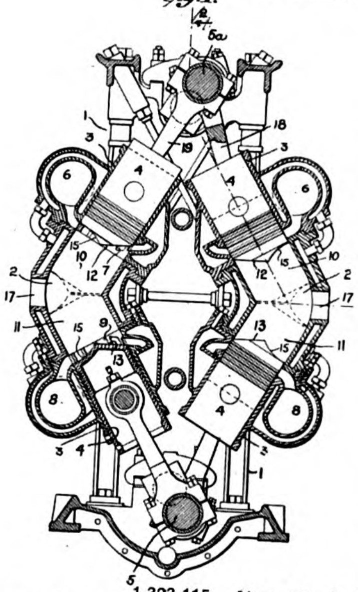
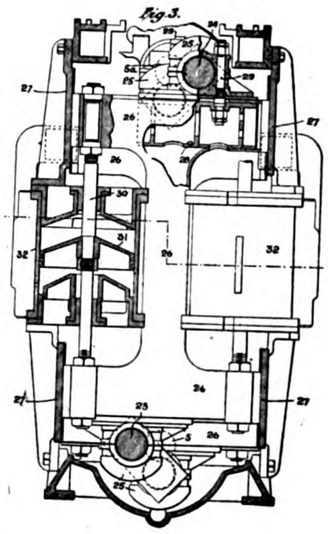


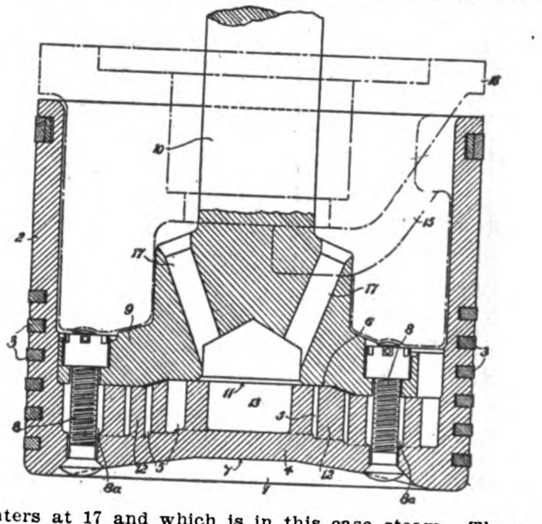
Fig. 3.



1,323,115. Nov. 25, 1919. Piston. W. J. Still, of London, England.

This patent refers to the design of a piston of internal combustion engines with the object to provide a relatively thin and well supported piston crown, so as to effect a more efficient cooling of the piston.

The accompanying cut shows this principle applied to a piston of the Still engine. The piston crown carries on its inside a great number of projections which form a labyrinth for the cooling medium which



enters at 17 and which is in this case steam. These projections support the piston crown on a bolster 9 on the end of the piston rod 10, and the piston proper is secured to the piston rod by means of bolts 8.

1,320,764. Nov. 4, 1919. Starting Diesel Engines. S. Klichenmann, of Winterthur, Switzerland, Assignor to Busch-Sulzer Bros. Diesel Eng. Co., of St. Louis, Mo.

The same invention has been published and illustrated in our record of Oct. 1919, as the British patent 125,913. The above note presents the American patent of the invention.

1,322,137. Nov. 18, 1919. Automatic Fuel Injection Apparatus. C. S. Salfeld, of Milwaukee, Wis.

This patent refers to an injection valve which can be used both for air or solid injection. A spring presses the needle valve on its seat and by reducing the diameter of the needle at the lower end the valve will be lifted against the pressure of said spring as soon as the oil pressure of the fuel pump reaches the required pressure.